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THE PAN-PACIFIC ENTOMOLOGIST

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The Pan-Pacific Entomologist

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APHID MISCELLANY[1]

E. O. Essig

University of California, Berkeley

In the middle of my junior year at Pomona College in 1908, Professor C. F. Baker suggested, as a special research problem, a study of the family Aphidae. The reason for this selection was the need for a better knowledge of these important injurious insects. The assignment at once aroused my interest because as a boy, raised on a ranch in Humboldt County, I was familiar with the ravages of the green and rosy apple aphids and the woolly apple aphid on our apple trees. I also knew the destructiveness of the cabbage aphid.

The collecting, mounting, drawing and otherwise studying these insects under the microscope was a revelation that I have enjoyed even to the present time. I doubt if one could have selected a problem more intricate and fascinating. And now after 45 years of almost continuous collecting and studying, I begin to feel that I am getting a good start. The rather phenomenal life histories of many species and the difficulties in the taxonomy of the group have caused me many an uneasy time.

And yet at the time when I began much had been written about aphids. Years before, Johann Leonard Frisch had published descriptions of aphids in 1720–1738. A. R. Réaumur had given a great deal of life history information in his Mémoires (1734–1742). Carl Linneaus had published his Fauna Svecica in 1746, 1761, Systema Naturae 1758, 1766–7; E. L. Geffroy his Histoire Abrégée des Insectes 1762; Carl de Geer Mémoires and other papers 1773–1780; Johann C. Fabricius the Systema Entomologica 1774, Genera Insectorum 1776, Systema Rhyngotorum 1803, Entomologica Systematica 1792–4, and Species Insectorum, 1701; and works of other less important earlier pioneers in this field.

A. Leuwenhoek, in 1690,[2] proved by dissection, that aphids contained within their bodies numerous immature young in various stages of development, some of which were ready for birth. A. R. Réaumur (1738) described such common species as the rose aphid,

[1] Presidential address before the annual meeting of the Pacific Coast Entomological Society at California Academy of Sciences, San Francisco, December 6, 1952.

[2] The dates following the name refer to years of publication.

sycamore poplar aphid, the willow aphid and others, and discussed the pseudogalls formed on the leaves by several species. The discovery of parthenogenesis in aphids by Charles Bonnet in 1745, added greatly to the interest in these insects and at once raised them to an important place in entomology and biology.

C. deGeer (1755), discovered the mating of male and female which proved sexual reproduction. He also noted that: (1) oviparous forms never produced living young; (2) viviparous females never deposited eggs; (3) viviparous females produced sexual males and females and the females laid the overwintering eggs that hatched the following spring—the egg surviving the winter; (4) if cold weather did not intervene no sexual forms were produced and he speculated that aphids living in the tropics might be entirely viviparous.

F. von Paula Schrank (1801) described some 60 species of aphids using relative lengths of the antennae, color, and comparative lengths of the cauda and cornicles to distinguish them. T. Hartig (1841, 1856) used also the wing veins in describing 33 species. Charles Morren (1836) described the internal organs of the green peach aphid, *Myzus persicae* (Sulzer). J. H. Kaltenbach (1843) also employed wing venation as a basic character in classification. His was the first great work on these insects. John Curtis (1828–1860) made many observations on aphids injurious to crops. C. L. Koch (1857) followed closely in the steps of Kaltenbach and described 213 species which were depicted in color. Succeeding these pioneers were a host of entomologists who have continued to discover new and remarkable characters and habits and the importance of these most interesting insects.

Aphidologists who made large contributions, especially in the systematics of aphids, and who followed the above mentioned founders were: P. F. Gmelin, 1785, C. H. G. von Heyden, 1837, and G. B. Buckton, 1876–1883, in England; Boyer de Fonscolombe, 1841, V. A. Signoret, 1867–1869, and J. Lichtenstein, 1874–1886, in France; G. Passerini, 1851-1865, and P. M. Ferrari, 1872 in Italy; and C. S. Rafinesque, 1817–1818; T. W. Harris, 1841–1862; Asa Fitch, 1851–1867, in the United States.

Closely following these pioneers were a host of systematic and economic entomologists who devoted a large part of their time to the study of aphids. The more important ones are arranged by continents as follows:

AFRICA

F. V. Theobald, 1906–1929; W. J. Hall, 1926–1932; L. B. Soliman, 1927–1938; J. Mimeur, 1931–1943.

ASIA

China—S. Teng and C. C. Tao, 1947;

India—B. Das, 1918; B. Krishnamurthy, 1928;

Korea—H. Okamoto and R. Takahashi, 1908; R. Takahashi, 1933;

Formosa—R. Takahashi, 1921–1934;

Japan—C. Sasaki, 1890–; G. Okajima, 1908; T. Matsumura, 1917–1931; G. Shinji, 1917–1952; R. Takahashi, 1918–; K. Monzen, 1923–; T. Uye, 1923–; M. Hori and K. Oshima, 1924; M. Hori, 1926–; M. Moritsu, 1949–.

AUSTRALIA

E. H. Zeck, 1928–; C. H. Hardy, 1931–.

NEW ZEALAND

W. Cottier, 1935–.

EUROPE

Belgium—N. Schouteden, 1900–1912; J. Leclercq, 1945.

Great Britain—J. Davidson, 1913–1929; M. D. Haviland, 1918–1921; F. Laing, 1919–; D. J. Jackson, 1918–1922; F. V. Theobald, 1902–1929; F. H. Jacob, 1940–; I. Thomas, 1940; J. Davidson, 1914–1945; H. G. L. Stroyan, 1950–.

France—P. Marchal, 1911–1933; A. Gaumont, 1913–1935.

Germany—H. F. Kessler, 1878–1882; C. Börner, 1904–; O. Nüsslin, 1909–1910; F. Schumacher, 1916–; Kurt Heinze, 1939.

Italy—L. Macchiati, 1881–1885; G. del Guercio, 1895–; F. Silvestri, 1911–1940; D. Roberti, 1938–; M. Martelli.

Latvia (Lettlands)—J. Zirnits, 1927–.

Netherlands—P. van der Goot, 1911–1918 W. Roepke, 1927–; D. Hille Ris Lambers, 1931–; H. J. De Fluiter, 1931–.

Roumania—W. K. Knetchel and C. Manolanche, 1945–.

Russia—N. Cholodkovsky, 1888–1922; A. Mordvilko, 1894–1935.

Sweden—A. Tullgren, 1909–1925.

Switzerland—O. Werder, 1929–.

The two most outstanding working aphidologists today in Europe are Carl Börner, Germany, (Russian Zone), and D. Hille Ris Lambers, Netherlands.

NORTH AMERICA – UNITED STATES

C. N. Ainsley, 1909–1915; P. N. Annand, 1924–1928; W. H. Ashmead, 1880–1882; A. C. Baker, 1915–1926; F. L. Bissell, 1928–; W. E. Britton, 1910–1933; W. T. Clarke, 1903–1907; T. D. A. Cockerell, 1901–1906; W. M. Davidson, 1909–1920; J. J. Davis, 1908–; T. H. Frison and H. H. Ross, 1933; D. T. Fullaway, 1910–1912; C. P. Gillette, 1907–1934; S. S. Haldemann, 1844–1850; J. L. Horsfall, 1923–1925; F. C. Hottes, 1926–; S. J. Hunter, 1910; C. F. Jackson, 1908; G. W. Kirkaldy, 1904–1910; G. F. Knowlton, 1925–; M. D. Leonard, 1931–; P. W. Mason, 1923–; A. C. Maxson, 1915–1934; F. W. Miller, 1932–; J. T. Monell, 1877–1882; O. W. Oestlund, 1886–

1942; H. J. Pack, 1929–; M. A. Palmer, 1926–; E. M. Patch, 1907–1938; Theo. Pergande, 1895–1912; C. S. Rafinesque, 1817–1819; C. V. Riley, 1869–1888; C. E. Sanborn, 1904–1906; E. D. Sanderson, 1900–1908; H. Shimer, 1867–1869; R. H. Smith, 1918–1923; L. B. Soliman, 1927– L. G. Strom, 1934–; A. F. Swain, 1918–1921; A. N. Tissot, 1927–; B. D. Walsh, 1862–1869; C. M. Weed, 1888–1893; T. A. Williams, 1891–1910; H. F. Wilson, 1908–1923; G. N. Wolcott, 1921–.

CANADA

R. N. Cyrstal, 1916–1925; A. P. McDougall, 1926; R. Glendenning, 1924–1929; F. W. Miller, 1933; W. A. Ross, 1915–1918.

SOUTH AMERICA

Brazil—C. Moreira, 1925–; A. de Costa Lima, 1946–.

Argentina — E. E. Blanchard, 1922–. (The most outstanding South American aphidologist.)

The brief introductory sketch is intended to call attention to the situation in aphidology, when I first ventured into the field in 1907 to the present time. There has always been competent help available, but most of the active systematists were in a sense beginners themselves and most were burdened with so many other entomological problems that they could spare but little time to determine species, provide literature, and otherwise aid the large group that was entering this field.

After getting a fair start my interest in aphids was distracted and almost obliviated by the secretarial work with the California State Horticultural Commission at Sacramento (1911–1914) and my coming to the University of California in August, 1914. However, I never completely lost my interest in these insects. All of my specimens were preserved and additions of new ones were made from time to time.

Unusual opportunities for collecting aphids were afforded on the Berkeley Campus and adjacent natural and cultivated areas in the San Francisco Bay Region, and especially on the University Summer School field trips to various parts of the State. Throughout the years I continued to collect and to solicit and trade specimens with aphidologists throughout the world. A year of sabbatical leave in Europe was for this purpose and afforded opportunities to collect extensively in England, Scotland and Wales; Belgium and less effectively in Switzerland, France, Germany, and Holland. Some six months of this time was spent mounting and studying specimens at the British Museum of Natural History in London and three months at the Belgian Congo Museum at Tervueren, the Museum of Natural History and the University of Brussels, at

Brussels, Belgium. This visit also gave me an apportunity to secure from second-hand book dealers, a large quantity of important literature on the Aphidae which has been of great value in determining specimens. Since then many entomologists have sent me quantities of aphid material in alcohol for determination.

A specialty of this kind grows like a snowball and the numbers of specimens amassed for determination pyramid until at times it seems that you cannot possibly continue because you know full well that the material will continue to increase in a geometrical ratio and you will spend the rest of your life determining specimens for other entomologists. Your all compelling urge to keep on in continually increasing your own collection and the gradual acquisition of missing links of species and genera, sexual forms and other missing stages never dreamed of, and in publishing a paper now and then. Once started on a line like this it is hard to turn to other matters that may seem to be of greater interest to your entomological associates and you gradually become an isolated figure.

To appreciate the difficulties in working out aphid life histories one need only attempt to follow through a complete season with any single species. Perhaps the simplest type is that of the cotton aphid, *Aphis gossypii* Glover. This aphid is one of the most widely distributed and cosmopolitan species in the world. It occurs almost everywhere excepting in the colder temperate and frigid zones, and in the hotter tropical regions in both the Northern and Southern hemisphere. It is more abundant in the Northern than in the Southern hemisphere because there is more suitable temperate land areas there. Twenty years ago we would have believed it to be a perfectly normal species, but now we have an uneasy feeling from the evidence at hand, that it is most unusual, because of the scarcity of sexuals in its life history. Among the hundreds of specimens in my collection are representatives of all parts of North America, South America, Europe, Asia, many of the Pacific Islands, Africa, Madagascar, Australia, New Zealand, and Tasmania. I have not yet collected a single male. Patch (1925), has observed wingless males on *Sedum purpureum* in Maine.

IMPORTANCE OF APHIDS

Aphids, like most other insects are both destructive and beneficial to mankind. They appear to be destructive only to plant life upon which they feed. They extract the juices of the plants causing

stunting, deformation, and death. The devastations of the so-called greenbug, *Toxoptera graminum* (Rondani), to growing wheat is a good example. Deformation of young fruit and foliage of apple by the rosy apple aphid, *Sappaphis mali* (Ferrari), (*Aphis sorbi* Kalt., *A. rosea* Baker), is well known both in Europe and North America. The transmission of virus diseases is the most destructive type of aphid damage to plants. Many kinds of viruses are involved and the numbers are increasing rapidly as investigators pursue the meticulous studies necessary in this intricate field of research. Of all the species of insect vectors known the green peach aphid, *Myzus persicae* (Sulzer), is the most important. This may be due in part to the fact that this aphid is one of the most abundant species and also has perhaps the greatest host range. In last summer's trapping investigations in the Yakima Valley, Washington, E. W. Davis caught thousands of aphids representing some thirty species and at least 95% of the individuals taken were of this single species.

At least one species, *Melaphis chinensis* (Bell) (*Schlechtendahlia*), produces a gall on *Rhus* spp. that is an article of commerce. The host plants are carefully raised and pruned so as to produce a growth that is enticing to the aphids and results in the greatest possible number of galls. In 1939 I received specimens of these galls, still containing dried aphids, in a lot of several hundred pounds imported into San Francisco from China. This species also occurs in Japan and in Formosa where it may have been introduced. A related species, *Melaphis rhois* (Fitch), produces similar galls on *Rhus glabra* (Linn.), in the New England States. Although the American Indians and the emigrant Europeans made a refreshing drink from the berries, apparently no use was made of the aphid galls.

Aphids furnish an abundant source of food for many birds and other small animals. The large quantities of honeydew excreted by aphids was early collected by most, if not all, aboriginal peoples as a delicacy. Before cane and beet sugars were available among the many kinds of sweets that were sought by savage and civilized man, honeydew was an important one. In the early history of California this sweet was called "Indian Honey" because the Indians collected and used it. The honeybee, wild bees, ants, and other insects are very fond of it and protect aphids in order to insure a supply. The so-called earthen "cow sheds" surrounding an aphid colony are evidence of the high regard with which they are held by certain

species of ants. One species of aphid, *Dysaulacorthum pseudosolani* (Theobald) (*Myzus*), has a very efficient way of removing drops of honeydew from the anus by flipping it away with the tarsi of the hind legs. This is done deliberately and accurately. I have noticed this feat only in this particular species.

Aphids are also heavily preyed upon by ladybird beetles, family, Coccinallidae; the leather-winged beetles of the family Cantharidae (Podabridae); aphid lions of the family Chrysopidae; the dipterous families Cecidomyidae and Syrphidae; by members of the hymenopterous families Incubidae (Aphidiidae) the Aphelinidae and many other insects. Fungi and bacteria also destroy many of them.

DISTRIBUTION

The movements and distribution of aphids is almost cosmopolitan. Except for certain restricted areas in the tropics and the polar regions, aphids are to be found living on almost the entire surfaces of the earth where plant life is possible.

However, they are predominantly a temperate group of insects and apparently reach their highest development and greatest numbers in the milder temperate regions. They meet, in a remarkable manner, all of the varied conditions of climate and host range throughout their habitat. Areas where aphids have been collected on their host plants include much of Asia, Europe, Africa, North and South America, Australia, and most of the islands of the temperate and tropical world. In fact, they appear to inhabit practically all regions where plants grow, excepting only the tundras of the polar regions, portions of the deserts, and perhaps certain of the tropical rain forests. I hesitate to make this last exception because even there certain aphids most likely occur, but have been overlooked.

One of the most remarkable phenomena in biology is the adaptations of aphids to their environment. Because of their great numbers and easy manner in which the untold numbers of alate parthenogenetic females are carried long distances by air currents, aphids are constantly being borne to all the possible favorable environments on the earth as well as to many where survival is not at all possible. The numbers of these insects that perish on land and water during their dispersal and migratory flights must reach staggering figures.

Living aphids reared in the coniferous forests of northern

Europe have been observed alive on the snowfields of Spitzenburg whence they have been carried some 600 miles by the wind. However, the constant movements insure the regular and continuous survival of these most delicate and vulnerable members of the insect kingdom. The great movements of aphids appear to be more in the nature of undirected dispersal due to air currents rather than by purposeful migration. Often these flights may be caused by the drying up of vegetation by a drought, a temporary or permanent hot spell or other causes that may destroy the host plants.

The casual movements that occur almost continuously throughout the spring, summer and fall are as frequent and continuous as air movements and aphids may be trapped in great numbers daily —even on quiet days. At times the air seems to be alive with these insects and their movements may be most indiscriminate. Apparently, there are so many aphids in the air that practically every host is infested—perhaps many times throughout a day or a season. Traps very clearly show these continuous movements day after day when the weather is warm and especially when warm and clear. On cold days very few aphids are captured. Francis Walker, the eminent English aphidologist, observed crowds of "aphids heaped along the seashore" in Southern England. This phenomena has never been noted elsewhere.

LIFE HISTORIES

An adequate discussion of the life histories of aphids would require several lectures and still be quite incomplete. As a matter of fact, I venture to say that the complete seasonal life histories of but few species are actually known. Thorough as such work may be and simple as the life cycle may appear the fact is that there are so many unexpected complications continually arising which seem to be unnecessary and unexpected that they are easily overlooked by the most meticulous investigator. In the case where thorough and, what appear to be wholly complete life histories have been made over a period of years, the results have been almost unbelievable.

It is not within the scope of this paper to detail any one of these complex life histories, but some remarks may be desirable, to indicate the extent of the order of complexity. Aphids reproduce parthenogenetically and sexually. Most species in the temperate regions combine both of these methods. A generation may start with hatching of the overwintering eggs in the spring. Such eggs

are normally laid by the sexual female on the branches of perennial deciduous or evergreen trees, depending upon the species. The aphids hatching from the eggs are usually wingless and when mature, or nearly so, they begin, without fertilization because there are no males at this season, to give birth to young of their own kind. These young mature rapidly and some remain apterous while others acquire wings. The exact factors that determine these two kinds are not fully understood but there has been much speculation on this phenomenon. However, the acquiring of flight appears to enable the dissemination of the species and to relieve overcrowding. The colonies multiply rapidly and vast numbers are produced —so many that no one has been able to adequately make a census for any given female that hatched from an overwintering egg and lived a normal life out-of-doors. Aphids may become so abundant that the dispersal flights may literally fill the air and many thousands of alates may be captured during a single day. The apterous forms, however, are very limited in their movements.

In a common type of life history the sexual males and females appear in late summer or fall, mate and the female lays 1, 2, or more egsg on the winter and spring host plant. All the living forms of such species then perish. In the early spring, sometimes even before the buds of the host trees begin to open, few or many eggs may hatch and by some means unknown to man these delicate minute young manage to survive quite cold weather until the foliage becomes available when the remaining eggs hatch. A single family may give rise to thousands of progeny during the year.

In climates like the lowlands of California, second instar young of the black peach aphid, as well as the adults and many stages of developing young of the cabbage aphid, apple-grain aphid, green peach aphid, potato aphid, and literally countless other species, survive our winters and begin reproducing young as soon as the weather is sufficiently warm to make this possible.

In contrast to these hibernating forms are the aestivating dimorphs of the maple aphids belonging to the genus *Periphyllus*. These almost microscopic first instar young remain appressed so closely to the leaf that they are scarcely visible to the unaided eye. They occur on either or both sides of the leaves and apparently take only enough food to sustain life and in California do not visibly grow from the middle of March until about the middle of September when they suddenly develop so that within fifteen days or there-

abouts, reach maturity and give birth to intermediates which also mature quickly and produce the sexuals. The latter mate and the females lay the overwintering eggs on the twigs of the maple trees. All living forms then perish.

During the almost seven months of summer following the birth of the dimorphs, the parthenogenetic alate and apterous forms of these maple aphids bring forth at least four generations of their own kind that disperse widely, but do not appear to have any part in the perpetuation of the species.

The alterations of host plants is another remarkable adaptation of aphids to their environment. There are many examples: the mealy plum aphid, *Hyalopteras puni* Geoffroy [(*H. arundinis* (Fab.)] which overwinters on *Prunus* spp., transfers in summer also to *Arundo*, *Phalaris*, *Phragmites*, *Poa*, *Scirpus*, and *Typha* species where the sexual males and the sexuparae are born, which migrate back to *Prunus* spp. to give rise to the sexual apterous females which, after mating, lay the overwintering eggs.

Summer generations after generations of alate and apterous females may continue to develop on the *Prunus*. In Berkeley, I had a prune tree that remained continuously infested with great numbers until December frosts and storms removed all of the leaves and the aphids. Since life histories of only a few species are accurately known, perhaps even greater complications may be revealed in the future.

COLLECTING

In determining aphids most systematists are assured of a fair start if host plant data is available. Therefore, it is somewhat disappointing to receive specimens without this important starting point. This means, of course, that aphidologists must be well trained in botany and especially in floriculture and horticulture, if they are working in economic entomology. An aphid without the name of its host plant is something like having a watch without hands. However, years of experience in systematic aphidology breaks down these barriers and the host plant nightmare may be greatly lessened or even obliterated completely.

Nevertheless, host plant data is essential not only to the systematist but to everyone who is concerned with the actual damage to crops caused by aphids and the numerous plant virus diseases carried and transmitted by these small and otherwise harmless insects. Consequently, any method of collecting that does not in-

clude the name of the host is still a barrier to almost all aphidologists. However, a new day in collecting these particular insects now makes it necessary to get accurate determinations without host plant data. Even so this is not different than is the case in determining species in most other groups of insects. The early coleopterists, dipterists, lepidopterists, and others apparently made little or no use of host plant data with the result that hundreds and even thousands of insects crowd our collections without our knowing very much about their exact food habits. Therefore, host plant data, important as it is, should not block the progress of systematic aphidology.

The recent use of aphid traps necessitates this reform. It has been known for many years that aphids could be collected on the surface of water barrels, in pans, and other similar containers. These specimens, if removed every two or three days could be mounted perfectly, but the lack of host plant data made this method of collecting objectionable. In recent years a great deal of progress has been made in insect trapping to study flight and dispersal, numbers and variety. Yellow sticky boards were used extensively in connection with the investigations on the control and eradication of a related insect, the pear psylla, in the State of Washington a few years ago. Sticky shields of various kinds have also been employed in determining the species of aphids that might be involved in transmitting virus diseases to various crops. During the last two years I made a great many determinations of them taken in the lettuce fields of the Salinas Valley. In England, sticky bands were used by L. Broadbent and T. W. Tinsley (1951), to prevent apterous aphids from reaching potted plants.

Yellow water pans appear to have been first used as aphid traps by Von V. Moericke in Germany, in 1951, and his suggestions were extensively employed by B. J. Landis and E. W. Davis, U. S. Bureau of Entomology at Yakima, Washington, during 1952 with very effective results. Experimental trap pans were placed at five different levels on a 20-foot tower. Very large numbers, attaining hundreds and even thousands of the green peach aphid, *Myzus persicae* (Sulzer), were taken in a single pan during a period of two or three days. These pans were maintained from spring until the rainy season and this year they were still effective in November, when the alate males of many species were captured along with the alate parthenogenetic sexuparae.

Upon returning to Berkeley from inspecting Davis' work in October, I immediately set up nine yellow pans in a vacant lot and in my garden on Creston Road which is on the crest of the Berkeley hills, at 1,000 ft. elevation. Two shades of yellow were compared: Dutch Boy ""Lemon Yellow," a true lemon yellow color, and Glidden's "Carnival Yellow" which is more of an orange color. The catches, of course, depend a great deal upon the condition of the weather here in this coastal region. On foggy, dull days very few specimens were taken, but on bright, sunny days as many as 250 were captured. The results were truly interesting. Although I have been collecting aphids in this region for thirty-five years, I caught a few species I have never seen here before, as well as alate males of a large number of species captured for the first time.

What appears to be a rather unusual capture was a single alate female with sexual tibial sensoria. A number of these were also taken in the water pans at Yakima, Washington.

LITERATURE ON APHIDS

The amount of literature published on aphids is far beyond and out of the reach of most of us who are delving into the mysteries of these insects. No one has as yet attempted to get together even the references to all the writings that have appeared.

H. A. Hagen (1863) in his *Sach Register:* "Bibliotheca Entomologica" under the title (13) APHIDAE (p. 449) lists 88 authors who published papers included in his great work. E. M. Patch (1938) lists 319 authors. In my own file there are listed approximately 2,500 separate articles having to do chiefly with the taxonomy and biology of aphids. These last mentioned articles have appeared in innumerable books, journals, separates and other publications. It has been possible to procure a great many of these and to have access to many more, but I doubt if any aphidologist has in his private collection, more than half of them. It is fortunate that most of these are accessible in University and Museum libraries. The lack of literature, or the neglect to use it, is responsible for much confusion in the taxonomy of these and all other insects.

COLLECTIONS

Fortunately, except for the earlier workers, aphids have been mounted in Canada balsam or some other similar medium, on glass slides and have been fairly well preserved. I have examined specimens mounted by Francis Walker (1846-1873), some of which

were over one hundred years old and, although the rather crude balsam used was quite dark, the specimens could be fairly readily examined under the microscope with proper lighting. Newer synthetic media such as "Euparal," "Diaphane," and other equally good preservatives are now being used. However, in spite of different types of more or less permanent mounting, there appear to be few well preserved *old* aphid collections in the world.

The best institutional ones I have seen are in the British Museum of Natural History, London, and the United States Bureau of Entomology and Plant Quarantine, Washington, D.C. In North America there are now a great many more recent collections possessed by Museums, Universities, and Agricultural Colleges and Experiment Stations. There are even more that may be regarded as private collections. Among the private and institutional collections that may be mentioned are those of R. Glendenning and Alice P. Macdougall at the Patterson British Columbia Museum of Natural History, Agassiz, B.C.; collections of L. C. Bragg, C. P. Gillette and M. A. Palmer, at Colorado State College, Fort Collins; collections made by Grace Griswold, C. R. Crosby and M. D. Leonard at Cornell University, Ithaca, New York; A. N. Tissot, University of Florida, Gainesville, Florida; S. A. Forbes, F. C. Hottes and T. H. Frison, Illinois Natural History Survey, Urbana, Illinois; C. E. Sanborn at the University of Kansas, Lawrence; E. M. Patch, University of Maine, Orono; O. W. Oestlund, University of Minnesota, Minneapolis; T. A. Williams, University of Nebraska, Lincoln; collections of Isabel McCracken, A. F. Swain, Wm. Davidson from Stanford University; the E. O. Essig and S. A. Kuwana collection of Japanese Aphidae, and the A. E. Michelbacher and E. S. Rose collection of South American Aphidae at the California Academy of Sciences, San Francisco; and others not definitely located at this time.

NEW CERAMBYCID BEETLES BELONGING TO THE TRIBE RHINOTRAGINI

(Coleoptera)

W. S. FISHER

This paper is a result of a study of the cerambycid beetles belonging to the tribe Rhinotragini received from Dr. E. Gorton Linsley and the California Academy of Sciences. Three species are described as new.

Odontocera meridianus Fisher, new species

Male: Elongate, slender, opaque except vitreous area of elytra; head and pronotum black; antennae brownish yellow (except basal segments which are black); elytra pale yellow vitreous, with lateral and sutural margins and narrow basal vitta on each elytron black; body beneath brownish black; anterior and middle legs reddish or brownish black; posterior femora brownish black with basal halves yellow, tibiae and tarsi brownish yellow.

Head prolonged into a very short, broad rostrum, longitudinally carinate or grooved, glabrous, rather densely, irregularly punctate; eyes large, deeply emarginate, separated in front by about the diameter of first antennal segment. Antennae extending to apex of first abdominal sternite, slender, cylindrical, slightly expanded and serrate toward apices, sparsely ciliate beneath on basal segments.

Pronotum subcylindrical, subequal in width and length, slightly wider at apex than at base, widest in front of middle; sides broadly rounded at apical thirds, then obliquely narrowed to bases; disk feebly convex, with two broad, longitudinal depressions, and a narrow, median, longitudinal carina; surface finely, confluently punctate, rather densely clothed with short, erect and recumbent, inconspicuous hairs. Scutellum densely clothed with recumbent, black and yellow hairs.

Elytra at base slightly wider than pronotum at apical third, extending to middle of fourth abdominal sternite, dehiscent along sutural margins; each elytron narrow and equal in width behind middle, broadly rounded at apex; surface indistinctly punctate on vitreous areas, coarsely, densely punctate at bases and along lateral margins, clothed with a few indistinct hairs.

Abdomen cylindrical, beneath sparsely, finely punctate, and densely, finely reticulate, densely clothed with short, recumbent black hairs, with a few long, erect hairs intermixed, the hairs at middle of first sternite whitish; last sternite broadly, arcuately depressed, with sides of depression elevated. Prosternum densely punctate, densely clothed with long, erect black hairs. Anterior and middle legs rather short; femora strongly, abruptly clavate. Posterior legs long and slender, femora gradually clavate toward apices, tibiae cylindrical, slightly expanded towards apices; all legs densely clothed with short, recumbent hairs. Length 13.5 mm., width at base of elytra 2.7 mm.

Type Locality: TABLILLAS, SALTA PROVINCE, ARGENTINE REPUBLIC.

Type: In the California Academy of Sciences, San Francisco.

Described from a unique male collected at the type locality by W. C. Harrington.

This species is allied to *Odontocera petiolata* Bates, but it differs from that species in having the antenna longer and more slender, each elytron much narrower and equal in width behind the middle, with the lateral and sutural margins and a small narrow vitta at base black, and the legs reddish or brownish black, with the tibiae, tarsi, and basal halves of femora of the posterior legs brownish-yellow.

Odontocera planitibialis Fisher, new species

Female: Form similar to that of *O. darlingtoni* Fisher. Head yellow, with elongate spot between eyes and broad transverse fascia on occiput black; pronotum yellow, with lateral and posterior margins, and a broad, irregular, median fascia black; antennae reddish brown, with upper surface of first segments black; scutellum yellow; elytra pale yellow, vitreous, with the lateral and sutural margins narrowly reddish brown, and each with an arcuate black fascia extending from humeral region backward to sutural margin a short distance behind scutellum; body beneath brownish yellow, with two transverse fasciae on prosternum, sternum in part, and posterior margins of posterior coxae black; legs brownish or reddish yellow, with posterior tibiae brownish black.

Head prolonged into a very short, broad rostrum, longitudinally grooved between eyes, glabrous, nearly impunctate in front, densely punctate on occiput; eyes large, deeply emarginate, separated in front by about twice the diameter of first antennal segment. Antennae extending to base of first abdominal sternite, slender, serrate toward apices, sparsely ciliate beneath.

Pronotum subcylindrical, slightly wider than long, subequal in width at base and apex, widest at middle; sides broadly rounded at middles; disk uniformly convex; surface coarsely, confluently occellate-punctate, glabrous. Scutellum elongate-triangular, nearly glabrous.

Elytra at base slightly wider than pronotum at middle, extending to middle of fourth abdominal sternite, dehiscent along sutural margins behind middles; lateral margins gradually narrowed from bases to apices, which are obliquely truncate; surface impunctate on vitreous areas, densely, coarsely punctate at bases, with a few erect, inconspicuous hairs.

Abdomen broadly elongate, beneath finely, indistinctly punctate, sparsely clothed posteriorly with short recumbent hairs; last sternite broadly rounded at apex. Prosternum nearly glabrous, finely, irregularly punctate. Legs rather short, sparsely clothed with short hairs; femora strongly, abruptly clavate; posterior tibiae broadly flattened on apical two-thirds, and densely clothed with long, semierect reddish hairs. Length 10.5–11.5 mm., width at base of elytra 2.5–3 mm.

Type Locality: PUMAHUASI, HUANUCO DEPT., CENTRAL PERU.

Type and paratypes: In the E. G. Linsley Collection, California Academy of Sciences.

Paratype: In the United States National Museum.

Described from 10 females (one type) all collected at the type locality at an elevation of 4000 feet, May 13–17, 1939, by F. Woytkowski.

This species resembles *darlingtoni* Fisher but it differs from that species in having the transverse median black fascia on the pronotum much broader, and the sternum in part black, and also from it and all other described species of *Odontocera* in having the posterior tibiae very broadly flattened.

Epimelitta (?) aureopilis Fisher, new species

Male: Very elongate and slender, moderately shining; head, pronotum and sternum black; antennae, elytra (except lateral and sutural margins which are black), and abdomen brownish yellow; legs brownish yellow, with upper surface of anterior and middle tibiae, and basal halves of posterior femora brownish black.

Head prolonged into a rather long, broad, rostrum, densely, finely punctate, with an indistinct longitudinal smooth carina on occiput, densely clothed in front with short, recumbent yellow hairs; eyes very large, deeply emarginate, separated in front by about one-half the diameter of first antennal segment. Antennae extending to apex of first abdominal sternite, slender, cylindrical basally, strongly serrate towards apices, sparsely ciliate beneath.

Pronotum distinctly longer than wide, subequal in width at base and apex, widest at middle; sides feebly rounded at middles, slightly constricted at apices and bases; disk strongly convex at middle, broadly, transversely concave along anterior and posterior margins, with a triangular depression in front of scutellum; surface coarsely, confluently punctate, very densely clothed with short, recumbent yellow hairs in concave depressions along anterior and posterior margins, along lateral margins, and triangular depression in front of scutellum, sparsely clothed with long, erect blackish hairs on convex median area. Scutellum elongate, broadly rounded at apex, densely clothed with short, recumbent yellow hairs.

Elytra at base as wide as pronotum at middle, short, elongate-triangular, extending to base of first abdominal sternite, strongly dehiscent along sutural margins behind middle, narrowly rounded at apices; surface coarsely, sparsely punctate on median part, more densely punctate along lateral margins, sparsely clothed with long, erect hairs.

Abdomen very long, cylindrical, slightly expanded towards apex, beneath densely, rather coarsely punctate, sparsely clothed along middle with short, erect yellow hairs; last sternite broadly, longitudinally concave, transversely truncate at apex. Metasternum very broad. Anterior and middle legs short; femora strongly, abruptly clavate. Posterior legs very long; femora very long and slender, cylindrical, slightly expanded toward apices; tibiae long, slender, cylindrical, very densely clothed on all sides with long, erect reddish yellow hairs, forming tufts on apical halves. Length 18.5–21 mm., width 2.5–3 mm.

Type Locality: Tolome, Veracruz Province, Mexico.

Type and paratypes: In the E. G. Linsley Collection, California Academy of Sciences.

Paratype: In the United States National Museum.

Described from 13 males (one type) all collected at the type locality, July 4, 1941, by C. H. Seevers.

This species differs from the other described species of *Epimelitta* in being very long and slender. It seems to be out of place in the genus *Epimelitta*, but since the genera are so badly confused, it does not seem advisable to erect a new genus for these males until a revisional study can be made of the tribe Rhinotragini.

THE ORCHARD GRASS APHID, HYALOPTEROIDES HUMILIS (WALKER)

(Hemiptera-Aphidae)

E. O. Essig

University of California, Berkeley

Since writing an article on this aphid (Pan-Pacific Entomologist, 21(3):119-120. 1945), I have obtained additional specimens which enable me to determine more definitely its true identity. The recent discovery of a large infestation on the blades of orchard grass on the campus of the University of California, Berkeley, by Frank Bold, a student in entomology, has furnished an abundance of apterous and winged specimens. To date the species is represented in my collection as follows:

(1). Sweeping grasses at Reigate, Surry, England, May 20, 1937. Collected by the author; 10 slides and many specimens—all apterae.

(2). On bush muhly or mesquite grass, *Muhlenbergia porteri* Scribn., Seattle, Washington, April 14, 1944, by M. J. Forsell; 3 slides—24 apterae.

(3). On orchard grass, *Dactylis glomerata* L., in greenhouse, campus, Oregon State College, Corvallis, Oregon, Feb. 24 and April 12, 1945. Collected by D. C. Mote and H. E. Morrison; 8 slides—40 apterae and 1 alate.

(4). On wild cane (?), Duchesne, Utah, August 17, 1940. Collected by R. H. B. (?); 2 slides—9 alatae.

(5). On grass, *Dactylis glomerata* L., Spring Mill, Pennsylvania, May 3, 1947. Collected by J. O. Pepper and G. B. Sleesman—2 slides, 6 alates and 2 apterae.

Specimens of this species, described by Hayhurst (1909) as *Hyalopterus dactylidis*, were collected as follows:

On orchard grass, Ft. Myer, Virginia; Washington, D.C., March 27, 1908; on red-top, *Tricuspis seslerioides* Torr. by C. N. Ainslie;

on orchard grass, Tennallytown, D.C., March 30, 1908; and on orchard grass, Forest Hills, Massachusetts, September, October to November 30, 1908, and on same host, April 8, 1909. The specimens which I have examined appear to be identical with those that I collected by sweeping grasses along the highway at Reigate, Surry, England, May 20, 1937, and which were determined by Mr. Frederick Laing, then of the British Museum of Natural History, as *Hyalopteroides pallida* Theobald (Entom. 49:51-2, 1916; Plant Lice or Aphididae of Great Britain, I:224-5, Fig. 123, 1926). This species has recently been defined by Carl Börner (1952, pp. 115-6) as follows:

Gen. Hyalopteroides Theob. 1916. T. a *H. pallida* Theob = *humilis* Walk. (Syn. *Hayhurstia* Mordv. 1921 T. a. *Hyalopterus dactylidis* Hayh. non d. Gu. 1913.

H. humilis (Walk. 1852). (Syn *Aphis humilis* Walk. 1852, *Hayalopteroides pallida* Theob. 1916, *Hyalopterus dactylidis* Hayh. 1909, *Hayhurstia dactylidis* Mordv. 1921).

Reference

Börner, Carl

1952. Europae centralis Aphides die Blattlause Mitteleuropas. Namen, Synonyme, Wirtapflanzen, Generationszyklen. Druck: Wei marer Druckund Verlagsanstalt Gebr. Knabe K. G. Weimar. Ausgabe: Thuringische Botan. Gesel. (Jena) und Biol. Zentrl. f Land-u. Forstw. (Zweigstelle Naumburg/Saale.—Nicht im Buchhandl— 259 pp.

Book Notice

The Grasshoppers and Locusts (Acridoidea) of Australia. Volume 1: Families Tetrigidae and Eumastacidae—by James A. G. Rehn. Commonwealth Scientific and Industrial Research Organization, Australia. Melbourne, October, 1952. 326 pp., 21 plates.

This is the first volume of a series intended to cover the entire Acridoidea fauna of Australia. If each volume continues in the style of the present one, the coverage will be very complete indeed. Mr. Rehn's descriptions of species and other categories appear to be very detailed and the line drawings and photographs supplement these. Although the economic importance of grasshoppers motivates the publishing of this series, the work is strictly academic and should thus provide a sound basis for applied studies.

It is to be hoped that funds will be forthcoming to enable Mr. Rehn to do a similar series on the American grasshopper fauna.—E. S. Ross.

A NEW MAYFLY GENUS FROM CALIFORNIA

(Ephemeroptera)

W. C. DAY

1021 Hubert Road, Oakland, California

On July 4, 1945, Harry P. Chandler, on a University of California field trip, collected a single nymph on Willow Creek, Madera County, California, that resembled in a general way the large nymphs of the Siphlonurus of this region, yet showed important morphological differences from any known species of this genus. Further collecting on Willow Creek by the writer and his wife during July and August of 1951 resulted in the rearing of adults from nymphs of this new species. In the author's opinion, this species cannot be included in any known genus of the Ephemeroptera.

In now erecting a new genus for the Willow Creek specimens above referred to, I take pleasure in naming it *Edmundsius*, in honor of Dr. George F. Edmunds, Jr.

Genus Edmundsius Day, new genus

Adult: Large mayflies, male adult of genotype having body 16.5, forewing 16.0, tails 20.0 and foreleg 11.2 mm. long; female adult of same size, with foreleg 8.0 mm. in length. Eyes of male contiguous, not divided, with lower portion darker; eyes of female separated by one and one-half times their diameter. Nasal carina very high, thin, and prominent. Posterior margin of head straight. Lengths of segments of foreleg of male genotype are: coxa plus trochanter 1.2, femur 2.6, tibia 2.2, and tarsus 5.2 mm., the tarsus being divided as follows: first tarsus 1.4, second tarsus 1.4, third tarsus 1.2, fourth tarsus .9, and fifth tarsus .5 mm. Claws similar on all legs, sharply pointed and hooked at tips. Lengths of segments of hind leg of male genotype are: femur 2.2, tibia 1.5, and tarsus 2.0 mm.; first tarsal segments of middle and hind legs completely fused with tibiae. The genotype has a compact group of 30 to 40 small spines in proximal half of fore femur of male adult, these being situated on the anterior surface; all tibiae of both sexes bear scattered small spines on margins, and coarser spines on all tarsi. Venation of wings as in figures 1 and 2, Plate IX. Styliger plate of male adult with a deep median V-shaped cleft on posterior margin, fully half as deep as wide. Forceps of male adult four-segmented; first segment short, ring-like, and partly fused with second segment which is over one and one-half times as long as third and fourth segments combined. Penes made up of overlying paired ventral and dorsal portions much as in numerous species of Siphlonurus. Ovipositor of female large, with heavy, raised lip. Two tails; vestigial median tail about .75 mm. in length.

Nymph: The large nymph, from 15 to 17 mm. in length, is perfectly streamlined. Head hypognathous and frontal margin deeply cut away on each side so that almost entire mandible is exposed; from the posterior margin to clypeus, median portion of head is somewhat elevated, presenting the appear-

ance of a low, longitudinal ridge as wide as the distance between the eyes. Posterior margin of head straight. Labrum deeply excavated in central portion; one-half as long as wide. Mandibles wide and strong, with heavy teeth on each. Maxillae somewhat conical at apex, with a few hairs on inner and upper margins at tip, and with four strong spines in same area on inner margin; palpi with three segments and one-third longer than the galea-lacinia; third segment of palpi quite dark. Labium as in figure 6, Plate IX; the three-segmented palpi with second and third segments completely fused, third segment being dark, very wide, and semi-truncate. Anterior margin of prothorax slightly concave and that of posterior margin straight. Pronotum slightly wider than head, and three times as wide as long. Mesonotum short and wide. A sharply ridged tubercle on scutelli of both mesonotum and metanotum. Legs of equal length and approximately three-tenths the length of the body. Claws long, slender, and without pectinations. In a typical specimen, the femur of the foreleg is 1,7, tibia 1.2, tarsus 1.4, and claw .65 mm. in length. On the middle and hind legs, the claw is twice as long as that of the foreleg, and slightly longer than the tarsus. Length of segments of hind leg are: femur 2.0, tibia 1.0, tarsus 1.2, and claw 1.3 mm. The thin, flattened lateral margins of the abdominal segments bear prominent and fine-pointed postero-lateral spines. Large, regularly oval gills are borne on segments 1–7, and are double on segments one and two; gills on segments six and seven about 15 per cent smaller than preceding gills; dorsal lamella of each double gill similar in form to, and about half again as large as ventral lamella; tracheae abundant, pinnate, dark, and easily seen. Tails, three of equal length, about two-fifths as long as the body; middle tail heavily fringed with long hairs on each side, and outer tails heavily fringed in inside.

Type of the genus, *Edmundsius* agilis Day, n. sp.

Remarks: The new genus *Edmundsius* can be placed in the subfamily Siphlonurinae as defined by Traver in "The Biology of Mayflies," 1935, page 443, but falls outside the limits of the genus *Siphlonurus*, to which it seems closest, in a number of important particulars. In *Siphlonurus*, the foreleg of male adult is at least as long as the body; in *Edmundsius*, it is only two-thirds as long. Compared to *Siphlonurus*, the new genus has hindwings relatively somewhat narrower and of slightly different shape. The long forceps base of the male adult of *Siphlonurus* is produced, straight, or very slightly convex in the various species, but in *Edmundsius* the apical margin is deeply and sharply cleft. The claws of the middle and hind legs of the nymph of *Edmundsius* are twice as long as those of any species of *Siphlonurus*. In all known *Siphlonurus* nymphs with double gills on the first and second abdominal seg-gills are smoothly oval in form. Comparisons between the mouthments, the dorsal and ventral lamellae of any pair are of equal size and have retuse distal margins; in *Edmundsius*, the ventral lamella

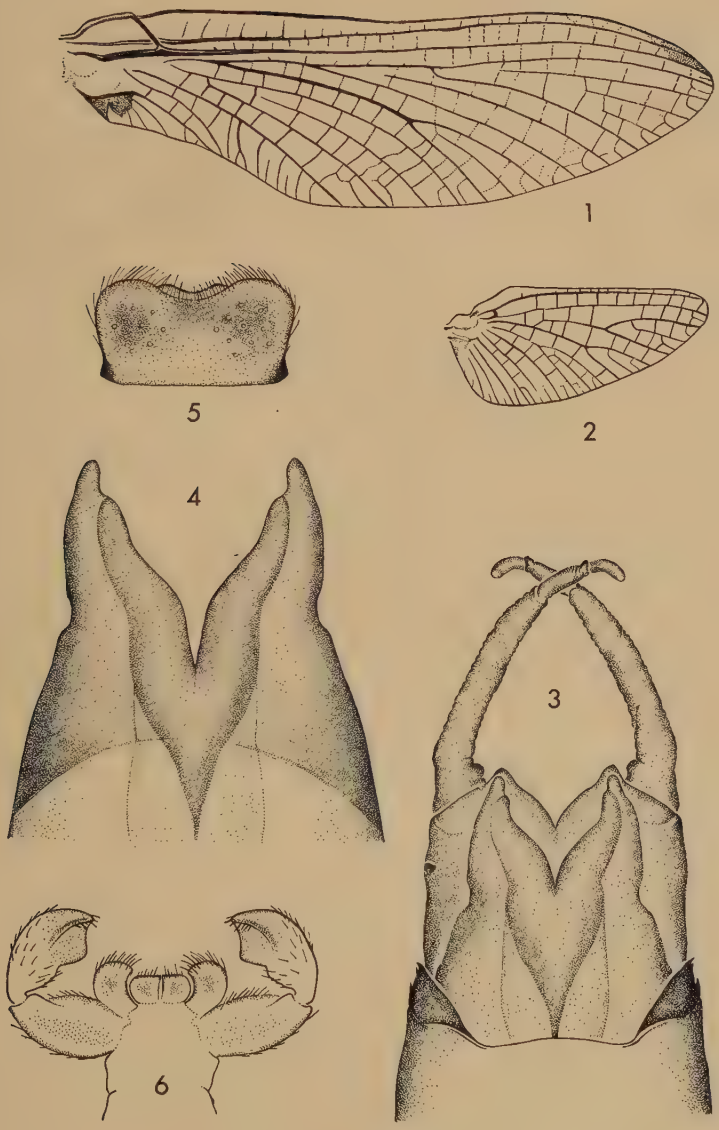

PLATE IX. *Edmundsius agilis*

Fig. 1. Forewing, male imago. Fig. 2. Hindwing, male imago. Fig. 3. Genitalia of male imago, dorsal aspect. Fig. 4. Penes of male imago, dorsal aspect. Fig. 5. Labrum of nymph. Fig. 6. Labium of nymph.

is about two-thirds as large as the dorsal lamella of the pair, and the parts of *Siphlonurus* and *Edmundsius* show the following distinctive features in the latter: the maxillary palp is 50 per cent longer; instead of being three-segmented and pointed apically, the labial palp has second and third segments entirely fused, and the third segment is very wide and semi-truncate; instead of being straight or slightly emarginate, the frontal margin of the labrum is deeply and widely excavated. Of particular interest, it is noted that the maxillary palp of *Edmundsius* is, in fact, very similar to that of a Japanese genus, *Dipteromimus*.

Edmundsius agilis Day, new species

(Plates IX and X, figures 1–13, incl.)

The morphological details of this species, the type of the new genus *Edmundsius*, have been given in the description above. Details that might be expected to be of a specific nature are as follows:

Adult: Vertex of head dark brown; clypeo-frontal area pale with wide, dark transverse hand across median carina; ocelli milky white ringed with black at base. Pronotum dark brown with black posterior margin. Mesonotum medium brown, darker in anterior area; scutellum paler brown with lateral and posterior margins black; a wide, pale, transverse band anterior to scutellum. Pleura dark brown, membranous areas milky white; a black stripe below forewing and another anterior to forecoxa. Mesosternum dark brown. Prosternum and metasternum white. Coxae brown with irregular lighter areas. Trochanters white, each with a single dark brown band on outside. Forelegs pale brown, proximal halves of femora and all tarsi slightly paler; ventral margins of femora narrowly edged with dark brown; a narrow, dark brown band partly around leg at proximal ends of femora and tibiae; claws same shade as tarsi. Middle and hind legs little paler than forelegs and marked in a like manner. Longitudinal veins of forewing dark chocolate brown; crossveins medium brown in basal portion, paling apically; crossveins of the costal strip dark only where attached to subcosta. In the hindwings, longitudinal veins dark brown; crossveins lighter in tone and paling apically. Abdominal tergites 2–9 light brown marked with fuscous as follows: a narrow band across posterior margins and small postero-lateral triangles; a short, oblique dash on each side of median line, arising one-third caudad of anterior margin; laterad of submedian dashes, a wide longitudinal band extending almost from anterior to posterior margins in basal segments, and becoming progressively shorter in apical segments. First tergite solid dark brown and tenth tergite dark brown with pale areas in antero-lateral corners. Sternites 1–8 pale brown with dark brown semicircular area on each; diameter of semicircle lies on posterior margins, being two-thirds as long as width of sternite on which situated; each sternite with dark brown oval ganglionic mark. Sternite nine solid dark brown. Styliger plate, forceps, and penes of male a concolorous tone of dark brown. Tails dark brown at base, paling distally.

Holotype: Male imago, reared from nymph; collected by Helen

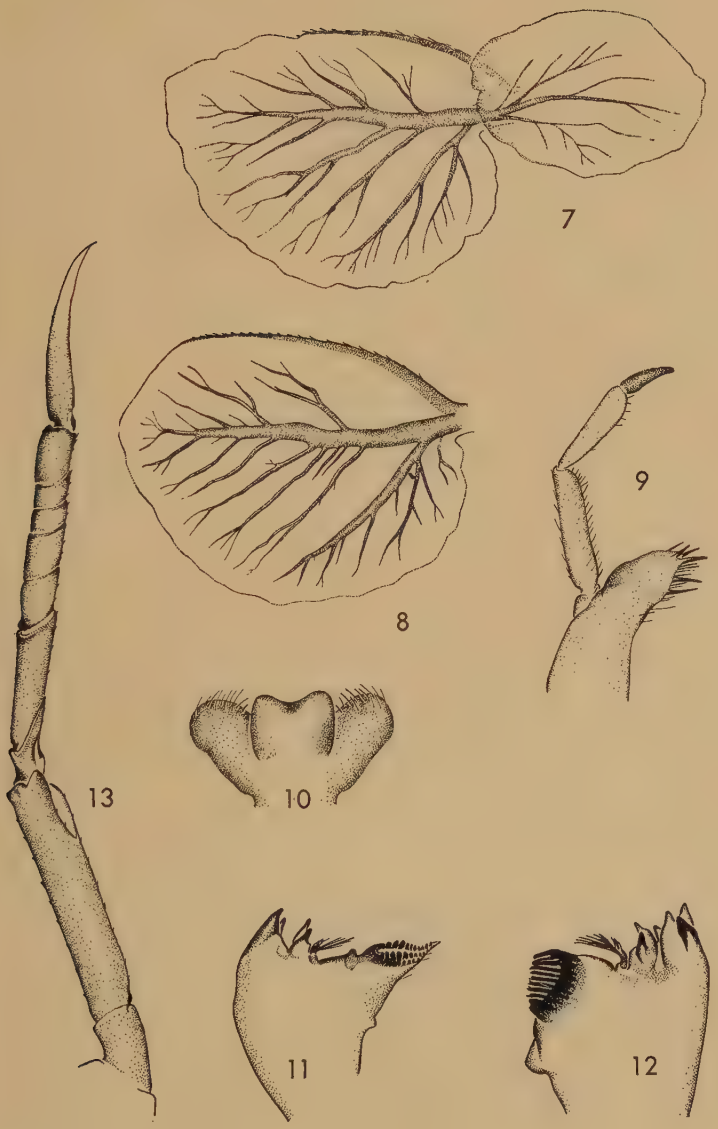

PLATE X. *Edmundsius agilis*

Fig. 7. Double gill of nymph, from first segment. Fig. 8. Gill of nymph, from third segment. Fig. 9. Maxilla of nymph. Fig. 10. Hypopharynx of nymph. Fig. 11 and 12, Mandibles of nymph. Fig. 13. Hind leg of nymph.

L. Day and W. C. Day at 7600 ft. elevation on Willow Creek, Madera County, California, about six miles northeast of the Alexander McGilvray ranch, July 20, 1951; in collection of California Academy of Sciences. *Allotype:* Reared female imago; same data; in collection of California Academy of Sciences. *Paratypes:* All topotypical; 1♂ (imperfect), 1 ♀, in Canadian National Collection, Ottawa; 1 ♂ (imperfect), 1 ♀, in Cornell University collection; 1 ♂ (imperfect), 1 ♀, in collection of G. F. Edmunds, Jr.; 1 ♂, 1 ♀, in author's collection. Forty-eight nymphs, 8 male subimagos, 10 female subimagos, and 27 nymphal cases in author's collection; nymphs have been sent with the above paratypes.

Nymph: Medium gray-brown in general tone. Head gray-brown with dark transverse band across face; occiputal area with darker mottling. Notum brown with irregular pale areas on mesonotum. Tergites 2–8 gray-brown with prominent clear white spots, one on each side, halfway between median line and lateral margin; mesad of white spots, a short, dark submedian dash arising from point close to anterior margin; laterad of white spots and under dorsal edge of gill, a wide, dark longitudinal stripe. A wide dark mark on segments eight and nine along median line, based on posterior margins and approximating anterior margins. Tenth tergite paler, with a pair of dark submedian stripes paralleling median line. Sternites 1–9 paler than tergites and with indications in the fully mature nymph of the dark semicircular areas seen in the adult. Legs pale brown, proximal halves of femora lighter; dark bands partly around proximal ends of tibiae; joints of tarsi finely but strongly marked with dark brown. Claws pale brown. Tails pale brown, darker at base and tips.

Biology: The nymph shows strong preference for quiet but well-aerated water, and rests close to the shady edges of pools on sand or fine gravel bottoms; the pools of Willow Creek at the type location are quiet portions of a cool, fresh, small stream of high gradient. In late July the nymphs were found at elevations of 7400-7900 ft. in water not over 60° F. maximum. In rearing cages the nymphs emerged between sunset and sunrise, and the subimagos transformed about two hours before sunset. For three weeks a careful watch was kept during the daylight hours for swarming adults or for specimens at rest on shrubbery or on trees, but none were seen. Low temperature after sunset, makes collecting at light unproductive. In captivity, the nymphs experienced little difficulty in transforming into the first winged stage, but the subimagos failed in four out of five instances, to pass into the final adult form.

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INTRASPECIFIC VARIATION OF TAXONOMIC CHARACTERS IN COLEOMYIA AND TWO NEW SPECIES

(Diptera: Asilidae)

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Oregon State College

The genus *Coleomyia* Wilcox & Martin (Bull. Brooklyn Ent. Soc.) was erected in 1935 to receive *Metapogon setiger* Cole the genotype, and three other species there described. During the past five years the writer and his wife have collected nearly 700 specimens of this genus. Also, a smaller collection, which includes paratypes of the species described by Wilcox & Martin, was assembled a number of years ago. Thanks are due my friend Mr. Joseph Wilcox for the series of *C. crumborum* from California. The types of *C. alticola* James and *C. setiger* (Cole) have not been seen, but there has been no difficulty in identifying the two species. The holotypes and allotypes of the three species described by Wilcox & Martin, *C. sculleni*, *hinei*, and *rainieri*, are at hand. Descriptions of two new species, a revised key, and a discussion of the intraspecific variation of the taxonomic characters used for the identification of the species of *Coleomyia* are presented. Holotypes and allotypes mentioned in this paper will be deposited on a permanent loan basis at the California Academy of Sciences. Paratypes, metatypes, and topotypes are in the writer's collection.

Coleomyia crumborum Martin, new species

Male: Length 6–7 mm. Head black; face, front, vertex, light yellowish or brassy, brown pollinose; occiput gray pollinose; palpi, proboscis, antennae, and all bristles, black. Ocellar bristles in 3 rows, arranged 4–2–2, outside anterior and posterior pairs weaker; 6 strong bristles on either side of occiput with other weaker bristles. Pale hair begins among occipital bristles and extends down and covers the lower occiput; pale hair on proboscis and palpi. Antennal proportions similar to other species of the genus. Holotype with pair of strong bristles on both first and second antennal segments, some paratypes with only a single strong bristle on these segments.

Thorax black, entirely gray pollinose with indistinct overcast pattern of light brown, median geminate dorsal stripe indistinct. Neck with pale hair, pronotum with pale hair and 2 weak pale bristles on either side opposite first spiracle. Bristle pattern similar to other species, 7 dorsocentral bristles. Pleura gray pollinose with slight tinge of yellow in some lights, mesosternum pollinose below with polished black spot covering about the anterior third of the sclerite; metasternum gray pollinose, pleura gray polli-

[1] Grant-in-aid Funds from Oregon State College contributed to the financing of these studies.

nose with 6 white hypopleural bristles. Dorsum of scutellum and margin gray pollinose with 3 strong marginal bristles and 4 short, weak bristles.

Abdomen black with short, pale appressed hairs and silvery gray pollinose markings on segments 1 to 5, segment 5 light brown on some paratypes, segments 6 and 7 brown pollinose. First segment pollinose on lateral margins, with 4 pale weak lateral bristles surrounded by pale hair as long as bristles; second segment pollinose on lateral margins with broad pollinose dorsal band as wide as anterior black dorsal area which is triangle-shaped posteriorly with the point extended as an indistinct, narrow line which almost separates the pollinose band, this line more distinct on some paratypes and less on others. Pollinose bands on segments 3 and 4 with anterior and posterior narrow dark crescents, and small posterior crescent on segment 5; a median line of thin pollen almost separates each band, more distinct on segment 3 on holotype, not so distinct on segments 3 to 5 on some paratypes and more distinct on others. Venter segments 1 to 4 gray pollinose, 5 and 6 brown pollinose, segment 7 polished brownish black; hypopygium brownish dorsally and brown and black ventrally, with black hairs.

Legs black; bristles black except posterior row pale bristles on anterior 4 tibiae; coxae gray pollinose with white pile.

Wings fumose; anterior crossvein usually distinctly before middle of discal cell. Halteres on holotype with brown base and yellow knob, some paratypes with orange-yellow knobs.

Female: Length 7–8 mm. Similar to male with these exceptions. Face, front, vertex usually darker than in male; posteriorly ocellar tubercle with brown pollinose triangle. Thorax, dark central brown stripe bisected by narrow, setulose, grayish brown pollinose line and separated from lateral golden pollinose markings by grayish brown pollinose line, humerus and lateral margin of meso- and metathorax gray to brown pollinose. Pleura gray pollinose, mesosternum gray pollinose below and posterior to anterior polished black spot, 5 black and 1 white hypopleural bristles on allotype, some paratypes with all white or all black hypopleural bristles, others with mixtures. Two strong, black median scutellar bristles with 2 weaker bristles. Abdomen black with short, pale, appressed hair; lateral margin first abdominal segment with most of lateral pollinose areas covered with white hair, 1 pale bristle on one side of allotype and 4 on other; anterior angle of second segment gray pollinose. Abdominal segments 2 to 5 with narrow posterior gray pollinose bands broadly interrupted in middle, segments 6 to 8 shining black; venter polished brown, posterior angles of segments 2 to 4 gray pollinose. Leg, bristles, and hairs on legs black.

Holotype: Male. San Bernardino Co., Barton Flat, 6300 ft., California, July 12, 1947 (J. Wilcox, Coll.)

Allotype: Female, August 9, 1942, same locality and collector.

Paratypes: Same locality and collector as holotype, 21 ♂ ♂, August 7-12, 1947; 1 ♂, August 9, 1942; 2 ♂ ♂, San Bernardino, County, Jenks Lake, Calif., July 18, 1943 (C. H. Martin, Coll.). Same locality and collector as holotype, 19 ♀ ♀, August 7-12, 1947;

2 ♀ ♀, August 9, 1942; 1 ♀, San Bernardino County, Jenks Lake, Calif., July 18, 1943 (C. H. Martin, Coll.).

Named for my friends Marion Pohlman Crumb, S. E. Crumb, Sr., and S. E. Crumb, Jr. (deceased).

Coleomyia rubida Martin, new species

Male: Length 6.5 mm. Face, front, vertex, occiput, grayish brown pollinose; proboscis, palpi, antennae, all bristles, black; 5 weak lateral frontal bristles, 4 strong and 4 weak ocellar bristles, about 16 weak black occipital bristles on each side of occiput, sparse pale hair on lower occiput, proboscis and palpi; 1 strong bristle on first antennal segment and 2 short weak ones on either side, 1 long and 1 somewhat shorter bristle on second antennal segment. Sparse pale hair on neck, even more spare pale hair on pronotum, one strong black bristle with 3 very short weak black bristles at base on each side of pronotum. Thoracic dorsum with dark brown central stripe narrowly separated by gray pollinose setulose stripe; reddish brown spot around base of first dorsocentral bristle and extending posteriorly as a line beside the central stripe and along the line formed by the dorsocentral bristles; a grayish brown pollinose line originating at the gray humerus and extending posteriorly around the margin of the reddish-brown spot to the second dorsocentral bristle where it continues parallel to the reddish brown line; lateral margins of dorsum same color as central stripe; transverse suture brownish pollinose. Pleura grayish brown pollinose, mesosternum gray pollinose above and posterior to the anterior polished black spot; metasternum and pleura gray pollinose, 2 black hypopleural bristles; scutellum dorsum brownish gray pollinose with margin broadly black, two scutellar bristles.

Abdomen black: lateral margins of first abdominal segment silvery pollinose with 4 pale bristles on posterior angle and pale hair anteriorly, small pollinose spot on anterior angle of second abdominal segment, narrow, widely interrupted silvery pollinose bands on posterior margin of segments 2 to 5, narrow, interrupted band on posterior margin of segment 6 golden brown pollinose, seventh segment with small lateral spot of golden brown pollinose on lateral margins; pygidium mostly dark reddish-brown with black hairs; venter with short, black appressed hairs, first segment brownish tan, narrow black line on posterior margin, second segment with narrow anterior and posterior tan bands, broad middle black band covered with white pruinosity, third and fourth segments black, narrow anterior and broad posterior bands joined medianly by transverse pollinose wedge, posterior margin same color as first segment, fifth and sixth segment polished black with narrow silvery pollinose band on posterior margin, seventh segment polished black.

Fore coxae black, thin gray pollinose, some sparse short white hair, posterior four coxae red, thin gray pollinose, middle coxae with fewer hairs than anterior coxae, posterior coxae without hair, rather short, weak, pale bristles on apices of all coxae, rest of leg black, femora with basal and apical red bands approximately the width of the second posterior cell in the wing, approximately basal third of tibiae red, bristles black. Claws black, pulvilli dark.

Halteres at base light brown, stem and knob yellowish brown. Basal three-eighths of wings thinly white, second basal cell almost totally white, hyaline band across discal cell, apex of wing lightly infuscated, discal cross vein at middle of discal cell.

Female: Length 10 mm. Similar to male. Abdominal segment five with a more broadly interrupted posterior narrow silvery pollinose band than other bands, sixth and seventh segments black. Black spot on mesosternum. Legs more reddish than those of male. Wings very lightly fumose. Pulvilli lighter than in male.

Holotype: Male. Mt. Hood, Still Creek Forest Camp, Oregon, August 10, 1947. Charles H. Martin, Coll.

Allotype: Female, Crater Lake, Oregon, August 8, 1947. Dorothy Martin, Coll.

Paratypes: One ♂, Deschutes Co., Paulina Lake, Oregon, August 9, 1946; one ♂, Mt. Hood, Parkdale, Oregon, July 19, 1947; two ♂ ♂, Crater Lake, Oregon, August 8, 1947, August 30, 1949, The Martins, Coll. Four ♀ ♀, Crater Lake, Oregon, August 8, 1930; three ♀ ♀, Mt. Hood, Parkdale, Oregon, July 19, 1947; one ♀, Deschutes Co., Paulina Lake, Oregon, August 9, 1946, The Martins, Coll.

Key to the Species of Coleomyia

Males

1. Basal portion of wing distinctly white, infuscated apically 2
– Basal portion of wing base not white, partially hyaline or totally infuscated 6
2. Dorsocentral bristles absent; pollinose wedge on hind angle of abdominal segment 2 barely perceptible or lacking, increasing in extent on 3 and 4, about equal in extent on segments 4 to 6. Length 6.5–9 mm. (Oregon; Idaho) ..... *hinei* W. & M.
– Strong dorsocentral bristles 3
3. Small pollinose wedges on posterior angle of abdominal segments increasing in extent from 2 to 6, frequently lacking on segment 2. Length 5.5–7 mm. (Colorado; New Mexico) ..... *alticola* James
– Either white, or brownish pollinose bands, or both, on posterior margins of abdominal segments, bands either interrupted, or complete, or both 4
4. Basal one-fifth of wing white, tip lightly infuscated; white pollinose bands on posterior margins of abdominal segments; knobs of halteres yellow. Length 7.5 mm. (Washington) ..... *rainieri* W. & M.
– Basal two-fifths of wing white, tip infuscated 5
5. Posterior abdominal fasciae widely interrupted; 4 posterior coxae red, white pollinose; femora black with prominent red band basally and apically, base of tibiae reddish, black apically. Length 5.5–6 mm. (Oregon) ..... *rubida* n. sp.
– Abdominal fasciae on posterior margin of abdominal segments entire; all coxae black, white pollinose; legs black except very narrow red inconspicuous bands on femora and tibiae. Length 6–8.5 mm. (Oregon; Washington) ..... *setiger* (Cole)

6. Knobs of halteres claret red; 3 to 6 dorsocentral bristles; anterior lateral margin of at least abdominal segments 2 to 4 black, segments 5 to 8 may be totally white pollinose or with lateral anterior black areas. Length 6.5–8 mm. (Oregon) ..... *sculleni* W. & M.
– Knobs of halteres vary orange, yellow, light brown; 7 to 9 dorsocentral bristles; laterial margins of abdominal segments 1 to 5 entirely white pollinose, 6 to 8 brownish pollinose. Length 6–7 mm. (California). ..... *crumborum* n. sp.

Females

1. Dorsocentral bristles absent; abdominal segments 1 to 5 with small, silver pollinose wedges on posterior angles. Length 7–9 mm. (Oregon; Idaho) ..... *hinei* W. & M.
Dorsocentral bristles present 2
2. Abdomen black; abdominal segments 2 to 5 with small wedges of silver pollen on posterior angles, 6 and 7 without pollen. Length 7–8.5 mm. (Colorado; New Mexico) ..... *alticola* James
Pollinose fasciae on posterior margin of abdominal segments entire or interrupted, or both 3
3. Wings hyaline; face, front, vertex, gray silver pollinose. Length 7—8 mm. (Washington) ..... *rainieri* W. & M.
Wings fumose; face, front, vertex, golden silvery or brownish pollinose 4
4. Posterior 4 coxae red, white pollinose; hind femora black with basal and apical red band; basal half or more of hind tibiae red, less red on anterior tibiae, apical portion black. Length 7–9.5 mm. (Oregon) ..... *rubida* n. sp.
All coxae black; legs black except very narrow red band basally and apically on femora 5
5. Narrow silvery pollinose band on posterior margins of abdominal segments broader in middle than on sides of abdomen; knobs of halteres claret red; usually one strong white bristle on pronotum. Length 7–9.5 mm. (Oregon) ..... *sculleni* W. & M.
Narrow posterior silvery pollinose bands on abdominal segments uniform in width; halteres not claret red 6
6. Usually one strong, black bristle on pronotum; bristles on lateral margins of first abdominal segment usually tan or dirty white; polished area on lower portion of mesosternum extends from anterior to posterior margins. Length 6.5 - 10 mm. (Oregon; Washington) ..... *setiger* (Cole)
Usually two or more weak, pale bristles on pronotum; bristles on lateral margins of first abdominal segment pale white; mesosternum gray pollinose below and posterior to anterior polished black spot. Length 7–8 mm. (California) ..... *crumborum* n. sp.

Intraspecific Variation

The shape of the antennae, the extent of the pollinosity or pruinosity, and the color and number of hairs or bristles present on the various parts of the body of Asilidae are commonly used as characters to separate species. The writer has often wondered how

stable these and other characters would prove to be when a fairly long series was studied. This study of *Coleomyia* shows that such characters in this genus do have a rather wide range within the species.

ANTENNAE—The shape of the antennae of all species of *Coleomyia* is not quite as dependable as implied by Wilcox & Martin, (l. c. p. 212). James (Kansas Ent. Soc. 1941) indirectly calls attention to this when he states that the figure of the antennae published for *C. sculleni* would serve for *C. alticola* James. A series of *alticola* collected by the writer confirms this observation. The variation found in the seven species at hand indicates that this character is not always dependable.

PRONOTAL BRISTLES—The bristles on the pronotum which are opposite the mesothoracic spiracle have been used in the key to separate the females of *setiger* from *crumborum*. Sometimes a strong pale bristle rather than the usual black one is found on *setiger;* on some specimens the bristle is found on only one side. There are usually several pale, weak bristles on *crumborum* but one specimen bears only a single weak bristle. In both species the bristles are associated with long, white pile.

GENITALIA—No differences were found in the male genitalia of *Coleomyia* which would readily separate one species from another. In all other genera of Asilidae studied by the writer, there are some structures of the genitalia which are of specific value.

VARIATIONS OF COLEOMYIA SETIGER

The writer has studied 335 specimens of *Coleomyia setiger* (Cole) from Mt. Hood, Santiam Pass, Corvallis, Washington County, and Mary's Peak, Oregon, and from Olympia, Puyallup, and Tacoma, Washington. The great variability in this species seems to be of no specific or subspecific value.

COLOR—The coloration of the pollinosity on the dorsum of both thorax and abdomen consists of two basic colors in *setiger*. Bluish-gray predominates on the thorax of the male, and brown on the female. In some specimens the brown markings are almost obscured by the bluish-gray pollinosity, while this color is obscured by the brown in other specimens. The males always have some brown present, but on some of the females the blue gray is completely replaced by brown shades.

The same variation in color is true for the pollinose stripes on the posterior margin of the abdominal segments. On some males

the brown overcast almost obscures the gray beneath, while in others the gray obliterates the brown on most of the segments.

SCUTELLUM—Both sexes of *setiger* could be divided into two distinct groups by the color of the margin of the scutellum. Sixty-five per cent of 320 specimens had the margin black, while the rest had pollinose margins. In a few specimens there was a graduation from pollinosity to black, but usually the character was sharp.

The number of bristles on the margin of the scutellum varied from two to six. When more than two bristles were present, the additional ones were sometimes short and sometimes as long as the median two. The female specimens from Mary's Peak, Oregon, shows a sharp tendency to have three or more bristles; 36 specimens had two bristles, while 41 had three to six bristles. In contrast, 45 specimens from Corvallis, Oregon, had two bristles, while only seven had three to six bristles.

ABDOMEN—The most surprising variability in *Coleomyia* is that the dorsum of the mid-segments of the abdomen is totally pollinose in some specimens of *setiger* and *sculleni*, while in other specimens of the same species the pollinosity is restricted to the posterior margin. With this character the 135 males of *setiger* at hand can be divided into these three distinct groups:

Group I—Pollinosity on posterior margin of fourth abdominal segment may extend as a distinct or indistinct median wedge toward or to the anterior margin; fifth abdominal segment totally pollinose.

Group II—Pollinosity on posterior margin of the fifth abdominal segment may extend as a distinct or indistinct median wedge toward or to the anterior margin. The anterior lateral angles may be either black or gray pollinose. Cole's type specimen with the anterior lateral angle black traces to this group.

Group III—The pollinosity on the fifth abdominal segment sharply confined to the posterior half of the segment; anterior half black.

Groups II and III share the common character of having the pollinosity of the fourth abdominal segment confined to the posterior half. Group II could be subdivided because the anterior lateral angle of the fifth segment is either lack or pollinose; the segment is never totally pollinose as in Group I.

A taxonomist with only a few specimens of the three distinct patterns would feel tempted to describe either species or subspecies. However, the series at hand leads the writer to consider these patterns in *setiger* as only variations within the species. Also other characters break the three groups into other major groups

which in turn are only variations within the species. The two groups based on the margin of the scutellum being either black or pollinose has been discussed.

The degree of pollinosity on the first abdominal segment breaks the males of *setiger* into two groups and the females into three. According to Cole's description of *Metapogon setigerum* (now *C. setiger*) (Proc. Calif. Acad. 4th ser. 9(7):235–236. 1919) the pruinosity of the first abdominal segment is confined to the lateral margins. There are many male specimens at hand which agree, but many others have the first segment entirely pollinose except for a posterior black, median crescent of variable widths. This posterior crescent is occasionally found on other segments of the abdomen.

The pollinosity of the first abdominal segment of 89 per cent of 198 females was generally confined to the lateral margins; 10 per cent had the pollinosity narrowly interrupted; 1 per cent were with the first abdominal segment totally pollinose.

The bristles on the lateral margin of the first abdominal segment were variable in color on 198 specimens. Five per cent of the female specimens of *setiger* had only black bristles; 80 per cent had light tan or sordid white bristles; 15 per cent had both black and pale bristles. The number of bristles ranged from two to six, and the number varied from one side to the other of the same specimen. There was a similar variability of number and color in the hypopleural bristles.

Venter—The venter of the males of some specimens of *setiger* was totally pollinose, on other specimens there were posterior and anterior pollinose bands on each segment, while in a third group these bands were connected by a median cross mark of pollen.

Halteres—The color of the knobs of the halteres of *setiger* is highly variable. On many specimens they are some shade of yellow, but on others the knobs are light brown, or some shade of pink. Most of the latter were collected at higher elevations in company with *sculleni*.

VARIATIONS OF COLEOMYIA SCULLENI

Two hundred forty specimens of *Coleomyia sculleni* W. & M. have been collected by the writer and his wife from Cloud Cap Road and Still Creek Forest Camp, Mt. Hood, Santiam Pass, Paulina Lake, and Crater Lake, Oregon, during July and August. The variability in this species is similar to that in *setiger*.

Scutellum—Both sexes of *sculleni* could be divided into two

distinct groups by the color of the margin of the scutellum. Seventy-eight per cent of 85 specimens from Crater Lake, 34 per cent of 70 specimens from Santiam Pass, and 96 per cent of 85 specimens from Mt. Hood had the margin pollinose. The margin was black in the rest.

The number of bristles on the margin of the scutellum varied from two to five. Forty per cent of the 85 specimens from Mt. Hood had three or more bristles, while 25 per cent of the 155 specimens from other localities had more than two bristles. The length of the bristles varied as in *setiger*.

ABDOMEN—*Coleomyia sculleni* shows a variability in the pollinose pattern on the abdominal segments which is similar to that in the three groups of *setiger*. In *sculleni* the males can be divided into two distinct groups:

Group I—The posterior, uninterrupted, silvery pollinose band of adominal segments three to six wider on the dorsum than on the lateral margin, leaving a black, anterior angle. The holotype specimen falls in this group.

Group II—The posterior, silvery pollinose bands of segments three to five similar to Group I except segment five has a smaller black, anterior angle. Segment six is completely pollinose.

There are other male specimens whose pollinose pattern represents a transition between Groups I and II. No other characters were found which would separate the specimens into the above two groups. Group II is represented by 50 males collected in an hour in an area of 100 square feet on Mt. Hood at Timberline Lodge. The abdominal pollinose pattern of two male specimens in the Timberline series resembled the typical *sculleni* of Group I.

The holotype male of *sculleni* bears posterior abdominal pollinose bands with a black triangular area on the posterior margin of the segments so that pollinose chevrons are formed. On most males of *sculleni* the bands are only slightly denuded posteriorly so as to form a very thin crescent. Of all the males collected, only two closely resembled the type specimen in possessing chevron-shaped pollinose bands. These specimens, which were collected at Crater Lake, August 30, 1948 by Dorothy Martin and by Chas. H. Martin, are designated metatypes. Also two females, Crater Lake, August 30, 1949, by the same collectors, are designated metatypes. Eighty-five other specimens with the same data as the metatypes are designated as topotypes. The number of lateral bristles on the first abdominal segment of *sculleni* varied from two

to six. The color ranged from black to pale brown to white. Frequently both black and pale bristles were on the same specimen.

STABLE CHARACTERS—Two characters of *sculleni* were more stable than others. All specimens had the knob of the halteres claret red. Usually there was a white, stout bristle on the pronotum opposite the first spiracle on the mesonotum. This bristle was black on a few specimens including the allotype.

SCUTELLAR BRISTLES IN OTHER SPECIES—The number of bristles on the margin of the scutellum has been discussed for *setiger* and *sculleni*. A series of 42 *Coleomyia alticola* James from Taos-Colfax County Line, Highway 64, New Mexico, July 30, 1948, Martins, Coll., had only two bristles on the scutellum of all specimens. In *C. rainieri* W. & M. the number varied from two to six. The maximum number of scutellar bristles on *C. hinei* W. & M. was two, while 14 per cent of 62 specimens had only one bristle. Apparently there is a tendency toward reduction of scutellar bristles in *hinei*. *C. crumborum* Martin shows the opposite tendency; all of the 48 specimens had three to six bristles; none had two.

TWO NEW HIPPOMELAS

(Coleoptera–Buprestidae)

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In the California Academy of Sciences collection there are two *Hippomelas* from islands in the Gulf of California, currently considered as "varieties" of *H. planicosta* (LeConte), which appear to require separation. The two new forms are apparently closely related to each other, but they differ appreciably from *H. planicosta*.

Hippomelas insularis Helfer, new species

Male: elongate oval, shining black with some punctures bluish or brassy, and with a yellowish efflorescence over the surface, more brassy beneath. *Head* brassy, becoming blue at occiput. Front broad, coarsely, closely setopunctate and with small irregular impunctate areas, the setae silvery and moderately long; antennae 11 segmented, reaching to hind angles of pronotum, inserted in rather small round cavities under sharp, prominent supraantennal ridges which are set at about 20° angles and which are almost connected across the front by a transverse carina which is separated from

the clypeal margin by coarse punctures; scape of antenna long, second segment less than half as long as third, segments four through eleven expanded, outer eight segments each with a little transverse subterminal pit in which are some antennal pores, and with pores disseminated thickly over the outer portions of both faces, terminal segment with a small quadrate appendix; eyes a little more broadly rounded beneath than above; clypeus shallowly emarginate medially, then broadly rounded at each side, becoming distinctly sinuate laterally; mentum testaceous; mandibles black, coarsely setopunctate basally; submentum black, coarsely setopunctate. *Pronotum* somewhat transverse, shining black with greenish brassy punctures; with a fringe of faintly yellowish hairs along the anterior margin which is feebly bisinuate; side margins sharp and clearly defined near base, fading out at middle and obsolete anteriorly. Viewed from above the pronotum is broadly rounded from the anterior angles to middle, then sinuate to posterior angles which are acutely rounded; disc sparsely coarsely irregularly punctate, more densely near front and at sides, with irregular smooth areas which form no distinct median line; basal margin smooth, entire, raised, distinctly trisinuate; pubescence inconspicuous. *Scutellum* transverse, rounded behind. *Elytra* broadest at base, narrowing evenly to posterior third, then more rapidly to apices which are emarginate and bidentate; feebly longitudinally costate, punctures weak, irregular, tending to form lines in feeble but definite striae; side margins feebly serrate near apices. Viewed from the side each elytron exhibits a distinct sublateral costa which persists nearly to the apex; efflorescence conspicuous, especially basally; pubescence inconspicuous. *Prosternum* sparsely setopunctate medially, more densely anteriorly and laterally; prosternal process not impressed medially, trilobate apically, the lateral lobes more narrowly rounded, with a deep submarginal stria which is strongest between the coxae and which fades out before the tip, with a row of long setae arising from the strial punctures; tip of process not touching metasternum. *Mesoternum* divided into halves; meso-metasternal suture distinct. *Metasternum* distinctly medially longitudinally grooved; metacoxal plates distinctly broader internally, cut off externally by a projection of the abdomen; posterior margin not straight. *Legs* coarsely moderately setopunctate and with whitish efflorescence; anterior tibiae distinctly internally subapically multidenticulate; tarsi slender, not as long as tibiae; claws simple; coxae small, subglobular. *Abdominal sternites* rather sparsely only moderately coarsely setopunctate, with efflorescence at the sides; first and second sternites with their dividing suture distinct for its entire length, the first not impressed medially, the second, third, and fourth with their posterior margins modified laterally into irregular teeth; tip broadly emarginate, with a little rough-margined subapical plate.

Female similar to male excepting the tip of the last sternite broadly rounded, and the anterior tibiae simple.

The holotype male, allotype female, and 39 paratypes all bear the same data: MARCUS ISLAND, GULF OF CALIFORNIA, VI-19-21, E. P. Van Duzee collector (California Academy of Sciences).

Very little variation was noted in the series. The largest female is 22.5 mm. long, 8.5 mm. wide, and the smallest male is 14.5 mm. long, 4.5 mm. wide.

To judge from general appearance this species is closely related to *H. planicosta* but differs from that species in having much less slender and elongate male genitalia, no smooth median line on the pronotum, (common on *H. planicosta*) and the surface of the elytra feebly costate, with more distinct albeit incomplete striae. *H. planicosta* has the elytra more strongly costate and the striae still less developed than *H. insularis*.

Hippomelas insularis castanea Helfer, new species

This form is very similar to the preceding structurally. It differs from typical *H. insularis* in the following respects:

H. INSULARIS	H. INSULARIS CASTANEA
Ground color of elytra black	Ground color of elytra chestnut brown
Transverse carina connecting supra-antennal ridges separated from clypeal margin by a punctate area	Transverse carina connecting supra-antennal ridges connected to clypeal margin by a broad impunctate area
Anterior trochanter with tooth less developed, inconspicuous	Anterior trochanter with tooth more strongly developed, conspicuous
Scutellum a little larger, more transverse, depressed anteriorly to accommodate pronotum in both sexes	Scutellum smaller, male with scutellum transversely depressed anteriorly, female with surface subequal
Male genitalia a little broader at middle, side pieces a little blunter at tips and with no dark pigment at tips	Male genitalia a little narrower at middle, side pieces more acute at tips and with tips distinctly darker

The male holotype, labeled ANGEL DE LA GUARDIA ISD., POND ISLAND BAY, GULF OF CALIF., VI-30-21, E. P. Van Duzee (California Academy of Sciences), measures 16.5 mm. long by 6 mm. wide. The female allotype, a little deeper brown in color, same data but collected July 1, measures 17.5 mm. long by 6.75 mm. wide. The male paratype, same data as holotype measures 15.5 mm. long by 5.75 mm. wide. All three specimens were taken on *Larrea mexicana*. This subspecies is very distinctive in appearance but seems very closely allied to *H. insularis*.

Types, allotypes, and paratypes in collection of California Academy of Sciences.

A HOST INDEX OF SOME ARIZONA FLEAS[1]

(Siphonaptera)

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In Dr. C. A. Hubbard's "Fleas of Western North America," published in 1947, are listed 42 species of fleas recorded from Arizona. These records are augmented by the following host index of 23 species and subspecies of fleas included in a collection assembled by the author at the University of Arizona. Most specimens are from Tucson and from nearby mountains in Pima County, although some fleas were collected in other parts of Arizona. One Mexican record is included. The first four species listed are common pests not native to the state; the last 19 are native to Arizona.

The scientific names of the fleas in the following list are preceded by the corresponding reference numbers used by Hubbard in his "Fleas of Western North America," except for one subspecies described since the appearance of that work in 1947.

1. *Echidnophaga gallinacea* (Westwood), 1875, commonly called the tropical hen flea. This introduced fowl flea is now at home on many wild birds and animals. It is here reported off:

   Bubo v. pallescens (horned owl). Tucson, Dec. 30, 1933: Tortillita Mts., Nov. 25, 1938.
   Cryptoglaux acadica (saw-whet owl), Tucson, Jan. 27, 1940.
   Sitta c. nelsoni (Rocky Mt. nuthatch), Ft. Lowell, Dec. 17, 1939.
   Cassidix mexicanus (great-tailed grackle), Chihuahua, Mexico, April 26, 1940.
   Geococcyx californianus (road runner), Tucson, Jan. 25, 1939.
   Colapter c. collaris (red-shafted flicker), Tucson, Jan. 28, 1939.
   Neotoma albigula (pack rat), Tucson, April 1930, Dec. 29, 1930, Jan. 1, 1931, May 23, 1933, Sept. 28, 1939.
   Citellus harrisi (Harris ground squirrel), Tucson, March 28, 1927, March 13, 1938.
   Citellus g. grammurus (Colorado rock squirrel), Tucson, March 25, 1938.
   Citellus tereticaudus (round-tailed ground squirrel), Tucson, March 28, 1929.

[1] The author wishes to thank Dr. C. A. Hubbard of Vanport College, Portland, Oregon, internationally known student of western fleas, who determined the fleas listed herewith and aided in the preparation of the manuscript.

[2] Died October 23, 1950.

Dipodomys sp. (kangaroo rat), Tucson, 1932.
Sylvilagus a. arizonae (Arizona cottontail), Pinal Mts., Gila, Co., 1932; Tucson, April 8, 1938.
Taxidea t. berlandieri (badger), Rincon Mts., March 30, 1933.
Bassariscus a. flavus (ring-tailed cat), Tucson, Aug. 23, 1933. This flea was taken in and under a house at Tucson, June 4, 1932.

4. *Pulex irritans* Linnaeus, 1758, the human flea, is a barnyard and city pest widely spread in North America. It is reported off:

Urocyon c. scotti (gray fox), Santa Rita Mts., Feb. 12, 1932, Feb. 21, 1933; Huachuca Mts., Cochise Co., Jan. 11, 1935.
Canis mearnsi (Mearns' coyote), Tucson, April 2, 1938.
Canis familiaris (dog), Tucson, March 31, 1930, June 4, 1932, March 26, 1940.
Lynx baileyi (bobcat), Sierrita Mts., Dec. 13, 1942.
Taxidea t. berlandieri (badger), Rincon Mts., March 30, 1933.
Bassariscus a. flavus (ring-tailed cat), Tucson, Aug. 23, 1933.
Mephites estor (skunk), Tucson, Jan. 12, 1931; Pinal Mts., Gila Co., Oct. 12, 1931.
Lepus c. eremicus (jackrabbit), Santa Rita Mts., April 19, 1932.
Citellus g. grammurus (Colorado rock squirrel), Tucson, March 25, 1938.
Dipodomys sp. (kangaroo rat), Tucson, 1932.
Vulpes m. neomexicana (New Mexico desert fox), Tucson, Dec. 27, 1937. This flea was taken at Tucson in and under a house June 3, 4, 1932; in a greenhouse June 11, 1940; in an auditorium May 13, 22, 1940.

6. *Ctenocephalides felis* (Bouche) 1835, the common cat flea, becomes a house and yard pest during the summer months. It is reported off:

Bubo v. pallescens (horned owl), Tucson, Dec. 30, 1933.
Felis domesticus (house cat), Tucson, Oct. 17, 1931, June 14 and Aug. 29, 1932, May 16, 1934, April 18, 1937, April 13, 1940.
Canis familiaris (dog), Tucson, Feb. 3, 1940. This flea was taken at Tucson in a house basement Aug. 31, 1942, and in a house yard April 13, 1940 and Sept. 20, 1941.

7. *Ctenocephalides canis* (Curtis) 1826, the common dog flea, seems less common than the cat flea. It is reported off:

Canis familiaris (dog) Tucson, March 1934, Sept. 10, 1938, March 1940. This flea was taken in a house at Wickenburg, Maricopa Co., May 16, 1946.

13. *Hoplopsyllus affinis* (Baker) 1904, is the small common rabbit flea of Arizona which does not bear genal teeth. It is reported off:

Lepus c. eremicus (Jack rabbit), Santa Rita Mts., Tucson, April 21, 1931.

Sylvilagus nuttalli (cotton-tail), Pinal Mts., Gila Co., 1932; Alpine, Apache Co., March 7, 1935; White Mts., Apache Co., Oct. 26, 1934; Santa Rita Mts., March 31, 1943.

14. *Hoplopsyllus anomalus* (Baker) 1904, is a widely-spread southwest ground squirrel flea. It is here reported off:

Citellus g. grammurus (Colorado rock squirrel), Tucson, March 25, 1938; Rincon Mts., April 3, 1938.

15. *Cediopsylla inaequalis inaequalis* (Baker) 1895, is the small wild rabbit flea of the southwest which has black genal teeth. It is reported off:

Sylvilagus nuttalli (cotton-tail), Pinal Mts., Gila Co., 1932; White Mts., Apache Co., Oct. 26, 1934.

17. *Anomiopsyllus nudatus* (Baker) 1898, one of the more common of the southwest wood rat fleas. It is reported off:

Neotoma albigula (pack rat), Santa Rita Mts., April and May 1930, March 6, 1933, June 27, 1936.

Neotoma m. bullata (wood rat), Santa Catalina Mts., June 5, 1934.

Sigmodon hispidus (cotton rat), Santa Rita Mts., March 22, 1932.

29. *Orchopeas sexdentatus schisintus* (Jordan) 1929, a common wood rat flea of Arizona south of the Grand Canyon, is reported off:

Neotoma albigula (pack rat), Tucson, May 23, 1933, Jan. 15, 1935, Feb. 4, 18, April 1, 1938, March 6, April 10, 1940.

Sigmodon hispidus (cotton rat), Tucson, April 10, 1940.

30. *Orchopeas sexdentatus neotomae* (Auguston) 1943 is also a flea of common occurrence in Arizona south of the Grand Canyon. It is reported off:

Neotoma m. bullata (wood rat), Santa Catalina Mts., June 5, 9, July 13, 1934.

Neotoma albigula (pack rat), Santa Catalina Mts., Jan. 15, 1935.

38. *Orchopeas howardi* (Baker) 1895, is an eastern tree squirrel flea reported off:

Sciurus a. huachuca (tree squirrel), Santa Rita Mts., Feb. 22, 1932.

46. *Opisodasys robustus* (Jordan) 1925, is a southwestern flea found on true tree squirrels. It is reported off:

Sciurus a. catalina (Catalina gray squirrel), Santa Catalina Mts., Oct. 22, 1938.

60. *Thrassis a. arizonensis* (Baker) 1898, is a common ground squirrel flea of the southwest. It is reported off:

Citellus harrisi (Harris ground squirrel), Tucson, March 28, 1927, Feb. 20, 1934, Feb. 11, 1937, Feb. 4, March 13, 1938, March 13, 1940; Santa Rita Mts., May 10, 1932.

Citellus tereticaudus (round-tailed ground squirrel), Tucson, March 28, 1929, Feb. 4, March 15, 1938, March 13, April 13, 1940, March

14, 21, April 27, 1942; Santa Rita Mts., April 7, 1930, Feb. 29, March 14, 1932.

Sylvilagus a. arizonae (Arizona cotton-tail), Tucson, April 8, 1938, March 6, 1939.

Sigmodon hispidis (cotton rat), Tucson, March 6, 1940.

63. *Thrassis pansus* (Jordan) 1925 is reported off:

Citellus g. grammurus (Colorado rock squirrel), Rincon Mts., April 3, 1938.

Citellus harrisi (Harris ground squirrel), Tucson, Feb. 4, 25, 1938.

64. *Thrassis setosis* (Prince) 1944 has been taken off:

Citellus harrisi (Harris ground squirrel), Tucson, March 28, 1927, Feb. 11, 1937.

Citellus tereticaudus (round-tailed ground squirrel), Tucson, March 14, 1942.

Citellus leucurus (antelope ground squirrel), Navajo Mts., June 13, 1933.

69. *Diamanus montanus* (Baker) 1895, a very common western ground squirrel flea is reported off:

Citellus g. grammurus (Colorado rock squirrel), Tucson, March 25, 1938; Rincon Mts., April 3, 1938.

Citellus tereticaudus (round-tailed ground squirrel), Tucson, April 22, 1938.

76. *Opisocrostis hirsutus* (Baker) 1895, the southwest prairie dog flea, is reported off:

Cynomys gunnisoni (Prairie dog), Red Lake, Coconino Co., June 13, 1933.

89a. *Foxella ignota omissa* (Prince) 1945 has been taken off:

Thomomys sp. (pocket gopher), no locality mentioned, May 1913.

(—). *Monopsyllus wagneri kylei* (Hubbard) 1949 is reported by the describer as being the southern variation of this northern species. It has been taken off:

Peromyscus m. sonoriensis (deer mouse), Santa Catalina Mts., June 28, 1934.

133. *Ceratophyllus celsus* (Jordan) 1926 is reported off:

Sitta p. melanotis (black-eared nuthatch), Flagstaff, Sept. 1, 1934.

150. *Odontopsyllus dentatus* (Baker) 1904 is a common large rabbit flea found everywhere through the Rocky Mountains and west to the Pacific Ocean. It is a true rabbit flea but can also be found on the carnivores which feed on rabbits. It is here reported off:

Lynx rufus (bobcat), Tucson, Feb. 18, 1939.

181. *Stenistomera alpina* (Baker) 1895 is another of the Rocky Mountain and southwestern wood rat fleas. It is here reported off:

Neotoma m. pinetorum (wood rat), White Mts., Apache Co., Oct. 26, 1934.

232. *Myodopsylla collinsi* (Kohls) 1937 was described from the Santa Rita Mountains, south of Tucson, off cave bat. It is here reported off:

Myotis v. velifer (cave bat), Tucson Mts., April 2, 20, 1938.

SEXUAL DIMORPHISM AND SYNONYMY IN ANTHONOMUS (ANTHONOMORPHUS)

(Coleoptera: Curculionidae)

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The subgenus *Anthonomorphus* was proposed by Dietz[1] and *Anthonomus fulvus* LeConte was designated as the type. Two additional species were described in this same work, *A. peninsularis*, from a male specimen, and *A. pervilis*, from a female specimen, both from Lower California (Ulke Collection). A distinguishing feature of these two "species" was said to be the "strikingly different coloration," *A. peninsularis* being pitch black, *A. pervilis* ferruginous. In addition, the head in the latter "species" was described as not constricted behind the eyes and a transverse indentation was stated to be present above the eyes. These distinctions are misleading, and the use of these characters has led to a confusion in identification. The males of this group are black, and the eyes are large and bulbous with their posterior margin meeting the head at a slight constriction. These features give the eyes a more prominent appearance and accentuate the constriction of the head. The females are ferruginous and the eyes are smaller and only slightly convex, not attaining the constriction of the head. This character provides the impression that there is no constriction immediately behind the eyes, but merely a transverse indentation some distance above the eyes. However, an occasional male intergrade is found. Since these characters represent sexual dimorphism and since *A. peninsularis* has line precedence, it is proposed that *A. pervilis* be regarded as a synonym of *A. peninsularis*.

In California, *A. peninsularis* has been found east of the Sierra Nevada Mountains in Inyo County, and at Piñon Flat, in the Santa Rosa Mountains, Riverside County. The only host recorded has been furnished by Dr. E. C. Linsley, who found this species on *Sphaeralcea ambigua* at Piñon Flat.

[1] Dietz, W. G. 1891. Revision of the genera and species of Anthonomini inhabiting North America. Trans. Am. Ent. Soc., vol. 18, pp. 177-276.

SOME SIPHONAPTERA FROM PIMA COUNTY, ARIZONA

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While on a collecting trip through Arizona and into Mexico, several days in February 1951 were spent in Pima County, Arizona.

Many mammals were collected from this county. Most of them were taken from the area of the Lower Sabino Canyon Park, east of Tucson. Some, however, were collected just off Highway 86, twenty miles west of Tucson.

The mammals were caught in number four rat traps, in number two steel jaw traps, and several were shot with a .410 gauge shotgun. Each mammal collected was carefully placed in a paper bag containing cyanogas and the bag was tightly closed. Twenty minutes later the animal was removed and examined for ectoparasites. The Siphonaptera that were found were preserved in vials containing a 70 per cent alcohol solution. Study skins were made of the mammal hides. These were positively identified by Dr. E. S. Booth, Professor of Biological Science of Walla Walla College, College Place, Washington, and were placed in the Museum of Natural History of the biology department of Walla Walla College.

A sampling of the mammals that were caught and the fleas found on them are as follows:

HOST	NO. HOSTS	FLEAS	NO. FLEAS
Citellus harrisii	1	*Thrassis arizonensis*	7
		Thrassis setosis	3
Citellus variegatus	1	*Hoplopsyllus anomalus*	7
*Citellus tereticaudus**	1	*Thrassis arizonensis*	13
		Echidnophaga gallinacea	3
Citellus tereticaudus	1	*Thrassis arizonensis*	3
Neotoma albigula	1	*Orchopeas sexdentata*	11
		Thrassis arizonensis	7
		Echidnophaga gallinacea	4
*Urocyon cineroargenteus**	1	*Pulex irritans*	6
Conepatus mesoleucus	1	*Pulex irritans*	24
		Echidnophaga gallinacea	4

* Collected 20 miles west of Tucson.

I wish to acknowledge my indebtedness to Dr. C. Andersen Hubbard for his identification of the above mentioned fleas.

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SEASONAL VARIATIONS IN MYZOCALLIS CALIFORNICUS BAKER

(Aphididae)

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In a previous paper I gave as my opinion that *Myzocallis maureri* Swain was probably not a synonym of *Myzocallis californicus* Baker. Since that time, through the kindness of Professor E. O. Essig I have had the opportunity to study the type and several cotypes of *M. maureri* now in his collection, and a long series of slides also from his collection, determined either as *californicus* or *maureri*. I have also seen the type slide of *M. californicus* Baker which is now in the U. S. National Museum.

Aphid workers may find of interest the data which leads me to believe that we are dealing with a single species which produces seasonal variations.

What the factors are that produce these seasonal changes and their manner of action must await experimentation. One quite naturally suspects temperature and moisture as being primary, but whether they act alone, or associated, direct or indirectly through the host, will have to be determined.

M. californicus was described from material collected by Davidson at Walnut Creek, California, April 6, 1916. The type and cotype material of *M. maureri* was collected by Swain at Berkeley, California, during June and July, 1915. If one were to base an opinion on a study of the type material alone, he would have to conclude that the two forms are distinct. One would reach a similar conclusion from a study of material collected in the vicinity of Berkeley before the middle of April or after the middle of June. The form from which *californicus* was described is characteristic of specimens taken in early spring. It differs from the form *maureri* which is characteristic of specimens taken in summer.

In the vicinity of Berkeley specimens characteristic of the species described as *californicus* by Baker may be taken up to the latter part of April in most years. Such specimens differ from the summer form *maureri* in having a larger number of secondary sensoria on the third antennal segment, a longer anal vein, in the shape of the radial sector, the length of the radial sector, and in the angle by which the radial sector meets the margin of the wing.

The transition from the forms characteristic of spring to the forms characteristic of summer is not abrupt, but is marked by the advent of intermediate forms. Taken alone these intermediate forms are difficult to place specifically, and it is not surprising that in the past some of these have been determined as *californicus* while others have been determined as *maureri.* The intermediate forms as a rule have fewer secondary sensoria than the spring forms but more than the summer forms, their anal veins are intermediate and the shape and length of the radial sector and the angle by which it meets the margin of the wing is also intermediate. There is a surprising correlation between the number of secondary sensoria and the length of the radial sector, the shorter the radial sector the fewer the secondary sensoria.

In the vicinity of Berkeley intermediate forms appear the latter part of April and continue present until the fore part of June. It is interesting to note the influence of altitude, which most likely plays a part because it influences other factors, which in turn bring about the seasonal variations. By chance the specimens on three slides were collected in Yosemite National Park, California. In Yosemite the type characteristic of spring was taken on May 15th, the intermediate form on July 6th, and the summer form on

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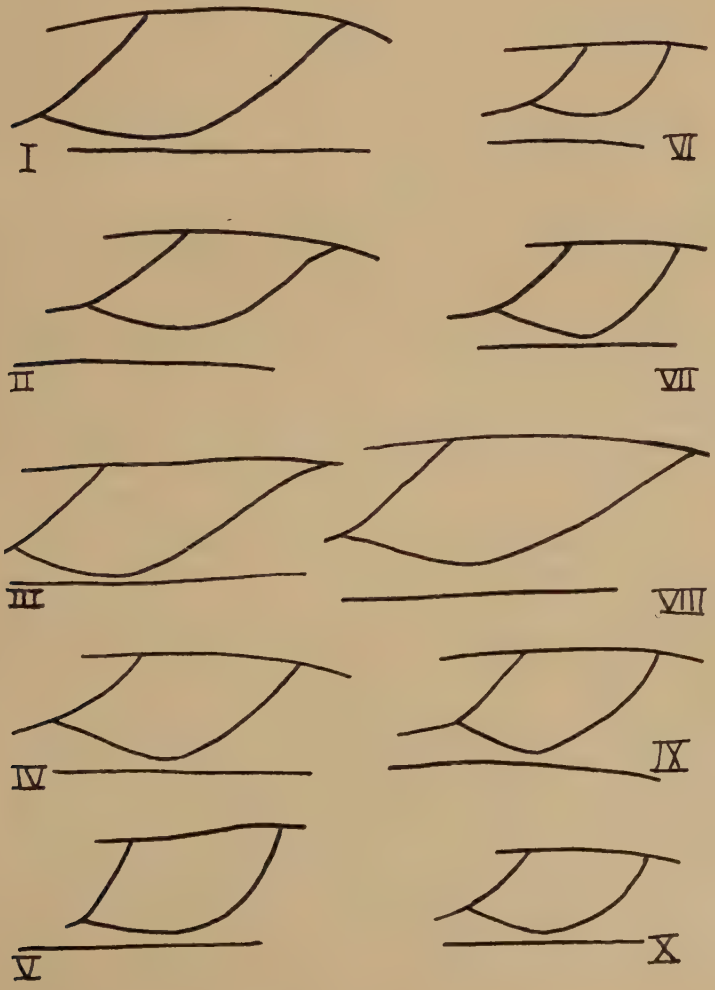
Figures I - X. Variations in wing veins of *Myzocallis californica* Baker. In each case the line under the radial sector represents the relative length of the anal vein. All drawings were projected, hence are to the same scale. It should be noted that while all specimens fit the general scheme that not all were taken in the same locality or year, hence are strictly speaking not as desirable from the standpoint of comparison as they might be.

Fig. I. Specimen taken at Berkeley April 6, 1916, six to eight sensoria. Typical of early spring form. Fig. II. Specimen taken at Berkeley May 3, 1916. Six sensoria. An intermediate form. Fig. III. Specimen taken at San Francisco, May 4, 1930. Six to seven sensoria. A spring form. Fig. IV. Specimen taken at Berkeley April 14, 1916. Seven sensoria. An intermediate form. Fig. V. Cotype of *maureri* Berkeley, June 8, 1915. Five sensoria. A summer form. Fig. VI. Specimen taken at Berkeley June 21, 1916. Three sensoria. An extreme form. Fig. VII. Specimen taken from type slide of *maureri,* Berkeley, July 24, 1915. A summer form. Four sensoria. Fig. VIII. Specimen taken at Yosemite National Park June 9, 1928. A spring form. Six to eight sensoria. Fig. IX. Specimen taken at Yosemite National Park July 6, 1939. (Reasearch Reserve). Seven to nine sensoria. An intermediate form. Fig. X. Specimen taken at Yosemite National Park July 15, 1939. (Miguel Meadow). A summer form. Head absent.

July 15th, roughly a month later in each case than corresponding forms were taken in Berkeley.

It would appear that the name *maureri* should be retained for a seasonal form of *Myzocallis californicus* Baker.

Myzocallis tonkawa Hottes is a related species. It is known only from Colorado. It does not produce seasonal variations. If its sexual forms did not differ from those of *californicus* it might be considered a variety of that species, and come into the seasonal variations ahead of the spring forms of *californicus*, for it has a longer anal vein, a longer radial sector, and more secondary sensoria than does that species.



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CULICOIDES SPINOSUS IN OKLAHOMA

(Diptera: Heleidae)

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Culicoides spinosus was originally described by Root and Hoffman[1] from males taken at lights at Baltimore, Maryland. In that locality it was taken with *C. piliferus* Root and Hoffman, a species which was said to be closely similar to *C. spinosus* and, therefore, prevented the differentiation of females of the two species.

C. spinosus was isolated by the present writer at Shattuck, Oklahoma, from light trap collections (1948). The male genitalia differs from the diagram presented by Root and Hoffman in that the tip of the aedeagus is shorter and more truncate; the stem of harpes is almost the same width throughout; the bulb, at the base, is usually not distinct; and, usually, the inner processes of the side piece do not look that approximate in the whole view of the genitalia.

The accompanying female is superficially similar to *C. simulans* Root and Hoffman. Both are of about the same size and general appearance. The mesonotum of *C. spinosus* is brownish, with a grayish pubescence present in the form of two submedian stripes and two areas on each side, one in front and one behind. However, the mesonotum in general falls definitely among those without a distinct mesonotal pattern. The scutellum is brownish-gray; the halteres are whitish. The eyes are separate; the frons is brown; the antennae are lighter; the proboscis is well developed. The legs are brownish, and the knees are dark with light bands above and below.

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[1]Root, F. M., and W. A. Hoffman. The North American species of culicoides. American Journal of Hygiene, 25 (1):150-176, 1937.

In the wing, the second radial cell is included in a dark spot, the light spots not being very distinct. There is a light spot beyond the second radial cell, and another large one on the cross vein, the spot being continuous with a narrow streak in front of vein Cu. A large light spot is present in cell Cu_1. The base of this cell is gray. A large spot is present at the tip of the anal cell, another one at the base, while the middle of this cell is gray. There is a small, faint light spot at the tip of cell M_2, and vein M_1, with faint light borders. There is no light spot at the tip of cell R_5 or the tip of cell M_1.

The last five segments of the antennal flagellum are more than one-third longer than the first eight. Of the palpi, the third segment is longer than the second and well swollen with moderate pit; the last two segments are subequal.

There are two large oval spermathecae, each about 60 micra long. The base of the duct is sclerotized only for a short distance. A rudimentary spermatheca is present, but no distinct ring.

Allotype: female, Shattuck, Oklahoma, May 26, 1948; with 5 *paraneoallotypes*, Shattuck, Oklahoma, 1948. All are desposited in the University of Oklahoma Museum, except one paraneoallotype which is in the U. S. National Museum.

Two examples of *C. spinosus*, a male and a female, were collected in Norman, Oklahoma, in 1948. Superficially these specimens more closely resemble *C. piliferus* than those collected in Shattuck, in that light spots are present at the tip of cell R_5 and at the tip and base of cell M_1.

A NEW SPECIES OF CALOSPASTA FROM UTAH

(Coleoptera: Meloidae)

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The following new species, which represents the first record of the genus *Calospasta* for the state, was discovered during the course of a study of the Meloidae of Utah. I am indebted to Dr. George F. Knowlton, of the Utah State Agricultural College, for making the specimen available to me, and to Dr. Edwin C. Van Dyke, of the California Academy of Sciences, for comparing the specimen with described species and concurring in the opinion that

it represents a hitherto undescribed form. I take pleasure in naming the species for Dr. George F. Edmunds, Jr., of the University of Utah.

Calospasta edmundsi Selander, new species

Female: Moderately shining. Color of head and pronotum aeneous blue-green; antennae and eyes dark brown; mouthparts in greater part piceous; elytra pale fulvous; rest of thorax, abdomen, and femora metallic blue-black; apices of femora; entire tibiae and tarsi tan to rufous, the tarsi darker. Pubescence pale yellow, more or less erect and rather dense on head and pronotum, partially obscuring surface; equally dense, but recumbent on elytra, sparse and subrecumbent on rest of thorax and abdomen.

Head one and one-tenth times as broad as pronotum, subquadrate; distance from vertex to apex of clypeus slightly less than distance across tempora; occiput truncate; frons flat, feebly and irregularly impressed medianly; surface coarsely and rather densely punctate; antennae short, filiform, moderately compressed, closely articulated, surpassing occiput by one segment, first segment robust, clavate, second half as long as first, third one and one-third times as long as second, fourth to tenth broader than long, fourth to seventh subequal in length, about three-fifths as long as third, eighth to tenth slightly longer than seventh, eleventh one and three-fifths times as long as tenth; eyes large, scarcely emarginate. *Thorax*, except pronotum, finely and sparsely punctate; pronotum broader than long, sides well rounded at humeral angles, scarcely divergent to a point almost even with apex, then abruptly and strongly convergent, surface evenly, coarsely, and rather densely punctate, disk with basal two-thirds moderately bulged, shallowly impressed before middle and basally on midline, with a large, deep, obliquely oval fovea on each side just behind middle; elytra rugulose, finely and densely punctate. *Legs* with posterior tibial spurs subequally slender, spiniform; tooth of tarsal claws long, slender, parallel to upper blade. *Abdomen* finely and sparsely punctate; sixth sternite truncate. Length 9 mm.

Holotype female: JOHNSON, KANE CO., UTAH, on *Helianthus* sp., June 22, 1950 (G. F. Knowlton and G. E. Bohart); deposited in California Academy of Sciences, San Francisco.

This species belongs near *C. viridis* Horn. Both species have the body robust, antennae short and compact, and the tooth of the tarsal claws nearly attaining the apex of the upper blade. In addition to differences of color, *edmundsi* is distinguished from *viridis* in having the antennae slightly shorter, pronotum smaller and less transverse, with the disk moderately bulged basally and less distinctly impressed on the midline, and with distinct lateral foveae, sixth abdominal sternite truncate, and the head, pronotum, and elytra more densely punctate and pubescent. The pubescence is also coarser in *edmundsi*, and because of this and its greater density, as mentioned, it affects the general color to a greater degree than in *viridis*.

NEW MUSCOID DIPTERA FROM THE WESTERN UNITED STATES[1]

H. J. REINHARD
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The current activities of the California Insect Survey have brought to light a goodly number of interesting muscoid flies, hitherto unknown from the state or new to science. The new species described below are based in part upon this material; the remainder constitute related forms, all western in distribution, received from several different sources as indicated under the descriptions.

Euphyto ruficeps Reinhard, new species

Female—Head subquadrate in profile, silvery pollinose on pale or reddish background; front at vertex 0.48 and at antennal base 0.42 of head width; parafrontals beset with a few small scattered hairs outside of frontal rows; latter converging downward and stopping at antennal base; outer vertical vestigial; one proclinate and one reclinate orbital, both small and set far back near upper edge of eye; ocellars well developed, proclinate; frontal vitta widening toward vertex, overlaid with dense pollen except along median line which is reddish-yellow from antennal base almost to triangle, clypeus moderately sunk on upper half, sloping forward from middle to the moderately prominent epistoma; latter short and slightly narrowed from clypeus; vibrissa hardly differentiated, on oral margin; facial ridge bare; parafacial bare, wider than clypeus; antenna short, barely reaching below mid face, second segment reddish with inner apical margin overlapping base of black third segment which appears unusually short in a direct frontal view; arista very short, bare, thickened basal two-thirds blackish, tip pale or whitish, proximal segments small; haustellum moderately slender, about one-half head height; palpus blackish; cheek very sparsely setose, one-fourth eye height; eye bare, reaching almost to vibrissal level; back of head with a sparse vestiture of black hairs.

Thorax and scutellum black with dense pale gray pollen, notum not vittate and weakly bristled; acrostichals not differentiated; dorsocentral 1, 3; notopleural 2; presutural 1 (outer); postalar 2; sternopleural 2 (with one or two intermediate hairs); scutellum with 1 lateral near base and 1 decussate subapical pair; post scutellum not developed; postnotal slope and propleuron bare. *Legs* moderately long and slender, black with tarsi more or less reddish in ground color, weakly bristled; fore tarsal segments ordinary; claws and pulvilli shorter than apical tarsal segment. *Wing* hyaline, veins pale yellow; costal spine not developed; first vein bare, third with three or four hairs extending from base nearly halfway to small cross vein; first posterior cell closed at costa far before wing tip; cubitulus obtusely angulate, usually without stump or fold; last section of fifth vein fully three-fourths length of preceding section; epaulet red; calypter opaque white. *Abdomen*

[1] Contribution No. 1515, from Department of Entomology, Texas Agricultural Experiment Station.

black, largely gray pollinose above with hind margins of last three segments shining and a narrow medium dark vitta visible in most views, weakly bristled; basal segments without median marginals; third and fourth segments each with a marginal row of small depressed bristles; sternites exposed; genitalia blackish, retracted within tip of abdomen. Length, 5 mm.

Male unknown.

Holotype (Calif. Acad. Sci., Ent.): 6 miles west of INDIO, RIVERSIDE COUNTY, CALIFORNIA, on flowers of *Melilotus*, April 30, 1949 (E. G. Linsley, J. W. MacSwain, R. F. Smith). *Paratype:* 1 ♀, same data as type.

The species is distinguished by the color of the head, shorter antennae and aristae, nearly bare parafrontals, etc. It differs from *E. subopaca* Coquillett (genotype), in having the second antennal segment reddish, and the first posterior wing cell closed at the costa or non-petiolate. The only other known allied species is *E. pollinaris* Reinhard, which is readily distinguished by its larger build and wholly gray non-fasciate abdomen.

Eumacronychia scitula Reinhard, new species

Male—Front at vertex 0.38 and at antennal base 0.32 of head width; parafrontal, parafacial, cheek and posterior orbit silvery white pollinose; frontal vitta pale yellow, widening gradually from anterior extremity to vertex and much wider than parafrontal on upper half; frontal bristles extending to base of antenna; two proclinate and one reclinate fronto orbitals; ocellars moderately large, proclinate; outer vertical bristle well developed but shorter than inner one; clypeus deeply sunk and about equal parafacial width; facial ridge bare except two or three bristly hairs next to vibrissa; latter near oral margin; parafacial moderately broad, clothed with short pale inconspicuous hairs on upper half and intermixed with coarser black ones below; antenna wholly reddish-yellow, third segment rather slender and about three times length of second; arista blackish, bare, thickened to slightly beyond middle; palpus reddish-yellow, slender with tip slightly thickened; proboscis short; cheek one-fifth eye height, beset with black hairs on lower half; eye bare.

Thorax gray pollinose with three to five black dorsal vittae which extend to scutellum in most views; acrostichals absent except hindmost pair; three post dorsocentrals and two sternopleurals; scutellum black with two stout lateral, one small decussate apical and two pairs of discals behind middle; infrascutellum recessive; prosternum, propleuron and postnotal slope bare.

Legs black; mid tibia with one anterodorsal bristle; claws and pulvilli exceeding length of apical tarsal segment. *Wing* hyaline with a slight grayish tinge; first posterior cell open far before wing tip; hind cross vein strongly oblique to fourth which it joins over two-thirds distance from small cross vein to cubitulus; latter angular and usually bearing a short fold; third vein setulose almost halfway to small cross vein; costal spine vestigial; calypter opaque white. *Abdomen* elongate conical extending well beyond wing tip, black with fourth segment including genitalia wholly reddish

yellow; last three segments with sharply defined silvery pollen bands on broad basal margin terminating abruptly at the side of each; second segment with one pair of median marginals; third and fourth each with a complete marginal row; genital segments prominent in repose, devoid of any bristles but the second segment bearing a vestiture of short black hairs above; forceps in profile rather slender, tapering to acute tips and in rear view separated and slightly bowed inward at tips; accessory process as long as forceps, moderately wide at base, tapering distally and curved rearward beyond middle, tip subacute; lobes of fifth sternite not prominent, reddish-yellow, clothed with black hairs on inner margin.

Female—Front at vertex 0.42 and at antennal base 0.42 of head width; third antennal segment often slightly infuscated on outer side; abdomen wider and more extensively pollinose than in male; median marginals on second segment weak and sometimes absent; first genital segment pruinose, bearing a marginal row of about ten good-sized bristles, the second segment retracted within first, anal orifice slitlike; claws and pulvilli shorter than apical tarsal segment. Length, 7–9.5 mm.

Holotype male and *allotype* female (Calif. Acad. Sci., Ent.): Tanbark Flat, Los Angeles Co., California, July 8, 1950 (A. T. McClay). *Paratypes:* 4 ♂ ♂ and 12 ♀ ♀, same locality as type, June 21 to July 28, 1950 (A. T. McClay, P. D. Hurd, J. W. MacSwain, M. J. Stebbins, K. G. Whitesell and J. C. Hall); 1 ♂, Crystal Lake, Los Angeles Co., Calif., June 29, 1950 (P. D. Hurd); 1 ♂, Big Dalton Dam, Los Angeles Co., Calif., June 25, 1950 (J. W. MacSwain) and 1 ♂, Pinon Flat, Calif., San Jacinto Mts., May 24, 1939 (B. Brookman).

The species is allied to *E. montana* Allen, which differs in having practically bare parafacials, a narrower front, and the male genital forceps divergent not bowed inward at the tips as in *scitula*.

Fabriciella invelata Reinhard, new species

Male—Front at vertex 0.22 of head width (four measured: 0.22; 0.22; 0.23; 0.21); parafrontal with pale yellowish-gray pollen becoming thinner and darker or blackish near vertex; frontal vitta deep red, wider than parafrontal on entire length; vertical bristles two pairs, fronto orbitals absent; ocellars proclinate; frontal rows widely divergent anteriorly, usually three bristles beneath antennal base; parafacial with dense satiny yellowish pollen, sparsely clothed with black hairs and distinctly narrower than length of second antennal segment; clypeus nearly flush, facial ridges flattened, strongly divergent downward, with three smallish bristles on lower extremity; epistoma broad, strongly bowed forward from clypeal plane; vibrissae stout, decussate, well above front edge of oral margin; antenna reddish-yellow, third segment blackish, broadly ovate and a trifle shorter than second; arista black, micropubescent, thickened on basal three-fifths thence evenly tapered to a fine tip, proximal segment barely longer than wide, second elongated, about one-fourth length of third; cheek slightly over one-third eye

height, with yellowish-gray pollen and a sparse vestiture of black hairs intermixed with finer pale ones on lower edge; eye bare; palpus reddish-yellow, moderately slender to tip and nearly as long as the rather short shining brown haustellum; back of head with a dense ruff of pale yellowish-white pilose hairs.

Thorax black, humerus reddish-yellow, this color extending posteriorly on side of notum to include callus and scutellum, thinly gray pollinose. Chaetotaxy: acrostichal 3, 3 or 4 (often irregularly spaced); dorsocentral 4, 4; intraalar 3; supraalar 3; humeral 6-8; posthumeral 2; presutural 2; sternopleural 3; pteropleural 2 (about as strong as sternopleural); intrapostalar weak; scutellum with 3 lateral, 1 strong decussate apical and 2 discal pairs, latter in a transverse row slightly behind middle of disc; propleuron black setose; prosternum and postnotal slope bare. *Wing* grayish hyaline, tinged with yellow basally; first posterior cell open far before wing tip; fourth vein strongly bowed inward beyond bend, latter with a distinct fold; third vein setulose one-third way to small cross vein; last section of fifth vein fully one-third length of preceding section; costal spine vestigial; epaulet infuscated; calypter white with a distinct yellow tinge. *Legs* shining black basally, tibiae and tarsi reddish-yellow; fore claws unusually elongated and but slightly shorter than combined length of last three tarsal segments; middle tibia with a row of five stout unequal bristles on outer front side; pulvilli long, pale tawny. *Abdomen* reddish-yellow with a moderately broad black median vitta extending from base to apex of third segment; latter and preceding segment whitish pollinose on narrow basal margin; pollen on anal segment tinged with yellow extending to middle or beyond on sides; second segment with one pair of median marginals, third with a marginal row and fourth with a marginal and two irregular discal rows behind middle; sternites exposed, beset with long slender bristly hairs; genital segments reddish-yellow, second with fine black hairs over entire surface and a transverse median row of about ten moderately strong bristles; forceps blackish, prominent and strongly arched in profile, united apex broadly rounded as viewed from the rear, hind surface except the slightly concave beak-like part clothed with fine black hairs which are longest and directed laterally on the sides; accessory process terminating in a slender inwardly bowed acute-tipped process; fifth sternite reddish-yellow, deflexed and prominent, median apical excision not extending ot middle; lobes broadly emarginate on hind edge, beset with black hairs and bristles. Length, 10.5–13 mm.

Female unknown.

Holotype (Calif. Acad. Sci., Ent.): TANBARK FLAT, LOS ANGELES CO., CALIFORNIA, July 8, 1950 (A. T. McClay). *Paratypes:* 48 ♂ ♂, same locality as type, June 19 to July 20, 1950 (A. T. McClay, W. O. Marshall, K. G. Whitesell, J. C. Hall, M. J. Stebbins, T. R. Haig, J. W. MacSwain, P. D. Hurd and J. D. Paschke).

In a restricted sense the species is congeneric with *Larvaevoropsis* (type, *Echinomyia dakotensis* Townsend), and appears closely related to *Fabriciella longiunguis* Tothill. However, a speci-

men compared with the type of the latter by Dr. G. E. Shewell, showed a distinctly greater frontal head width ratio and wider parafacials in the present form; also, the fore claws are perceptibly shorter than the three apical tarsal segments and the male genital forceps are more tapering apically and lack the dense vestiture of heavy lateral spines present in *F. longiunguis*.

Fabriciella plumasana Reinhard, new species

Male—Similar to the preceding species except as follows: Front wider, at vertex 0.30 of head width; parafrontal with pale yellow to golden pollen which extends to vertex; sternopleural bristles variable ranging from three to five in number; median abdominal vitta extending from base to apex; sternites two and three each with a dense cluster of longish moderately strong bristles; fifth sternite black apically with a moderately broad U-shaped apical excision, lobes prominent, sparsely black-haired; genitalia blackish, lower lateral margin of second segment thickly beset with short spinose hairs; forceps moderately compressed, strongly arched and prominent in profile, median hind surface or beak very narrow, parallel-sided and concave to near apex thence carinate to a slightly produced acute tip. Length, 12 mm.

Female unknown.

Holotype (Calif. Acad. Sci., Ent.): QUINCY, 4 mi. W., PLUMAS Co., CALIFORNIA, June 30, 1949 (Evert I. Schlinger). *Paratype:* 1 ♂, Canby, 6 mi. N., Modoc Co., Calif., July 19, 1950 (R. M. Bohart).

The species is closely allied to *F. spinosa* Tothill, from which it differs in the items listed and in the structure of the male genitalia. In *F. spinosa* the forceps are not at all compressed and obviously less prominent in profile, the concave beak-like portion is distinctly wider and tapers more abruptly before the apex; also, the lateral margin of the second genital segment bears fewer spinose hairs which are largely restricted to the lower anterior margin.

Fabriciella evanida Reinhard, new species

Male—Vertex 0.28 of head width; parafrontal gray to almost golden pollinose on blackish background, parafacial and cheek with paler yellowish-gray to white pollen on yellow ground color; median vitta red, much wider than parafrontal on entire length; verticals two pairs; ocellars long, proclinate; fronto orbitals absent; frontal bristles about 10 in a row, lowermost three or four beneath antennal base; antenna red, third segment largely blackish, about two-thirds length of second; arista shorter than antenna, thickened beyond middle and evenly tapered to tip, basal segment short, second one-fifth length of third; parafacial well over one-half clypeal width, sparsely clothed with black hairs; clypeus flush, with lateral ridges flattened and bare except on lower extremity; epistoma strongly protruding between vibrissae; latter well above oral margin; cheek slightly over one-third eye

height, sparsely black-haired; palpus reddish-yellow, slender to tip and about equal to length of haustellum; occipitial hairs pale yellowish-white.

Thorax black, lateral margin of notum, posterior callus, scutellum and sometimes humerus reddish in ground color, lightly dusted with white pollen but the entire surface moderately shiny in most views; chaetotaxy as in *F. invelata;* n. sp. *(vide supra)* propleuron setose. *Wing* as in *F. invelata. Legs* black, tibiae reddish-yellow, tarsi less distinctly so; fore claws and pulvilli obviously shorter than combined length of last three tarsal segments. *Abdomen* shining translucent yellow with a black median vitta which usually widens distally to include a large part of upper surface of last two segments; narrow basal margin of intermediate segments and basal third of last pale pollinose; bristling as in *F. invelata* except discal row on anal segment is near middle of latter; sternites exposed, beset mostly with long fine black hairs; genital segments largely blackish, second clothed with long black bristly hairs above; forceps arched but not very prominent in profile, viewed from behind the flattened slightly concave beak-like portion is unusually narrow and tapers rather sharply before apex thence gradually narrowing to an acute delicate tip; accessory process slender and bowed inward apically.

Female—Front at vertex 0.32 of head width; abdomen considerably darker, often black on apical half or more of last three segments above; otherwise similar to male except for sexual differences. Length, 9–13 mm.

Holotype male and *allotype* female, LAKE CITY, COLORADO, 8700 ft., August 8-15, 1936 (Chas. L. Fluke). *Paratypes:* 3 ♂ ♂ and 1 ♀, same data as type; 1 ♀, Pingree Park, Colo., August 17, 1932; 1 ♀, Cameron Pass, Colo., 9500 ft., August 21, 1940 (R. K. Fletcher); 1 ♂, Maniton Park, Colo., August (F. H. Snow); 1 ♂, Pleasant Grove, Utah, July 29, 1933 (G. F. Knowlton and L. L. Hanson); 1 ♀, Allen Canyon, Utah, August 21, 1942 (G. F. Knowlton and S. L. Wood); 1 ♂, Logan, Utah, August 2, 1950 (Ken E. Wolf); and 1 ♂, S. Grand Canyon, Ariz., August 17, 1949 (P. R. Fitzgerald).

In build and general aspect, the present species is quite similar to *F. brevirostris* Tothill, and like the latter has an uncommonly short haustellum. However, the genitalic differences, as noted above, appear distinctive.

Mericia hamilla Reinhard, new species

Similar to *M. ampela* Walker in general aspect but readily distinguished by differences in structure of the male genitalia as mentioned below.

Male—Vertex 0.21 of head width, front slightly narrower before ocelli; frontal rows strongly divergent anteriorly, three bristles beneath antennal base; no orbitals; inner verticals moderately long; ocellars long and slender; parafrontal pale yellowish-gray pollinose becoming blackish near vertex; parafacial equibroad and well over one-half clypeal width, with satiny yellow-

ish-gray pollen; cheek black, lightly dusted with gray pollen, nearly two-fifths eye height; eye thickly pilose; antenna black, first segment erect and somewhat elongated, third segment moderately wide and but slightly longer than second; arista bare, thickened on basal half tapering to a slender tip, middle segment barely longer than wide; facial ridge bare except a few bristles next to vibrissa; latter well above the lower front edge of the prominent epistoma; proboscis shorter than head height, labella large and fleshy; palpus yellow, beset with black hairs, back of head subshiny black, rather thickly clothed with pale hairs.

Thorax black, thinly gray pollinose, mesonotum subshiny, but with four broad dark vittae visible in a flat rear view; scutellum black, more or less reddish apically; acrostichal 2, 3; dorsocentral 3, 4; sternopleural 3; scutellum with 3 lateral, 1 decussate apical and 1 discal pair; postnotal slope setose; propleuron bare. *Wing* gray hyaline, with a light brownish tinge on costal margin near base; third vein with 3 to 6 small hairs near base; cubitulus rectangular, without stump or fold; first posterior cell open far before wing tip; calypter white. *Legs* black, tibiae obscurely reddish, moderately long and slender; claws and pulvilli elongate or about equal to combined length of last two tarsal segments. *Abdomen* black, genital segments red, with gray pollen which extends thinly to the broadly arcuate hind margin of last three segments above; one pair of discals on each of latter, first without median marginals; intermediate segments greatly narrowed on venter; keel of forceps triangular, deeply divided and nearly twice as large as in *M. ampela;* accessory process unusually wide at base, tapered gradually towards tip, subequal to length of second genital segment; fifth sternite subshiny black, with an apical U-shaped excision extending about to middle, lobes beset with long black hairs.

Female—Vertex 0.28 of head width; parafrontal quite blackish in most views, with two stout proclinate orbitals; outer verticals well developed; antennal segments one and two wholly reddish; mesonotum blackish and subshining as in male; fourth abdominal segment red; anal orifice large, ovate; first genital segment retracted, hind margin bearing a fringe of closely set black bristly hairs on distal half or more; apical sternites with a broad shallow groove at middle. Length, 11-12 mm.

Holotype male, Mt. Rainier, Washington, Sunrise, 6380 ft., July 31, 1932 (J. Wilcox). *Allotype* female, Puyallup, Washington, June 1, 1933 (J. Wilcox). *Paratype:* 1 ♂, Mt. Rainier, Washington, Shallow Lake, 6500 ft., August 15, 1932 (Chas. H. Martin).

Mericia cobala Reinhard, new species

Differs from the preceding species mainly as follows:

Male—Vertex 0.19 of head width; first and second antennal segments with a reddish tinge on apex, third segment larger, and broadly bulged on front edge; arista thickened well beyond middle; thorax moderately gray pollinose, mesonotal vittae rather well defined, four before suture and five behind; scutellum black with a barely perceptible reddish tinge at extreme apex; abdomen including genital segments, fifth sternite, forceps and accessory process black; carina of forceps moderately large, triangular, apex

slightly grooved behind; accessory process long, broad to middle thence gradually narrowed to tip; fifth sternite prominent, with a deep median V-shaped incision.

Female—Vertex 0.32 of head width; two pairs of strong proclinate orbitals; outer verticals developed; ocellars stout, proclinate; first and second antennal segments wholly reddish-yellow; fore tarsus distinctly flattened, claws and pulvilli shorter than apical segment; abdomen wholly black; fused sixth and seventh sternites with a wide deep groove which bears a narrow slightly elevated median carina; eighth sternite broadly impressed at middle, subtruncate on apex. Length, 12 mm.

Holotype male and *allotype* female (on same pin), Otero County, New Mexico, 8000 ft., June 20 (E. M. and R. H. Painter).

Zenillia scolex Reinhard, new species

Female—Front at vertex 0.36 and at antennal base 0.52 of head width; parafrontal pale grayish to brownish-yellow pollinose, distinctly wider than the deep red median vitta; ocellars strong, proclinate; verticals two pairs; frontals in two rows on lower half of front, the main row moderately divergent below and extending to level with base of third antennal segment; two stout reclinate prevertical bristles and two proclinate orbitals; antenna red, third segment slightly over twice length of second; arista brownish on thickened basal two-fifths, micro pubescent, proximal segments short; parafacial gray pollinose on reddish ground color, bare beneath lowermost frontals and but slightly narrowed below; facial ridge reddish, beset with small hairs and bristles on lower fifth or less; vibrissae descussate, on oral margin; eye hairy, reaching nearly to vibrissal level; cheek red in ground color, overlaid with thin gray pollen and sparsely black-haired, one-fourth eye height; proboscis short; palpus reddish-yellow; back of head gray pollinose, clothed with pale hairs. *Thorax* black, with opaque yellowish-gray pollen showing a brownish tinge on notum, latter marked with four very narrow black vittae; scutellum and posterior callus reddish. Chaetotaxy: acrostichal 3, 3; dorsocentral 3, 4; intraalar 3; supraalar 3; presutural 2; postalar 3; intrapostalar well developed sternopleural 3; scutellum with 3 strong lateral, 1 decussate apical and 2 discal pairs behind middle of disc; prosternum setose; propleuron and postnotal slope bare. *Legs* wholly red; mid tibia with three anterodorsal bristles and one inner ventral; hind tibia subciliate; yellow black-tipped claws nearly equal length of last tarsal segment, pulvilli slightly shorter. *Wing* subhyaline with a distinct luteous tinge on basal half of costal margin; third vein with two bristly hairs near base; first posterior cell open well before extreme wing tip; costal spine not developed; epaulet deep red; calypter opaque white. *Abdomen* short and thick in profile, with dense opaque yellowish-brown pollen on entire surface above becoming somewhat grayer on venter; intermediate segments with discals (sometimes doubled on one or both); first and second segments each with one pair of median marginals, third bearing a complete marginal row and fourth with a discal row and numerous irregularly spaced bristles between the latter and apex of segment; anal orifice slitlike, genitalia retracted. Length, 10-11 mm.

Male unknown.

Holotype (Calif. Acad. Sci., Ent.): TANBARK FLAT, LOS ANGELES CO., CALIFORNIA, June 30, 1950 (K. G. Whitesell). *Paratypes:* 1 ♀, same locality as type, June 22, 1950 (P. D. Hurd); 1 ♀, Crystal Lake, Los Angeles Co., Calif., June 29, 1950 (W. O. Marshall); 1 ♀, West Hollywood Hills, Los Angeles Co., Calif., April 24, 1950 (R. G. Howell); and 1 ♀, Forest Home, Calif., June 17, 1950 (G. P. Taylor).

The species apparently belongs to the *chrysomasicera*-group of *Zenillia*, but differs from all forms assigned here in the wholly red legs and antennae, bristling of mid tibiae and the non-golden, patternless pollen on the abdomen.

Meledonus lindensis Reinhard, new species

Male—Head uncommonly long and subquadrate in profile, cinereous pollinose; front at narrowest 0.37 and at vertex 0.42 of head width; frontal vitta brownish, gradually widened upwards, at middle subequal parafrontal width; inner vertical large, the outer vestigial, prevertical curved laterally; orbitals absent; ocellars long, proclinate; frontal rows not strongly divergent anteriorly and barely extending beneath antennal base; parafacial broad, sparsely beset with fine black hairs; clypeus rather deeply impressed; epistoma noticeably swollen or inflated and moderately produced downward beneath vibrissal level; facial ridge bare except a few bristles at lower extremity; antenna black, third segment twice as long as second; arista bare, short, thickened and tapering to distal third, basal segments small; haustellum slender, about two-thirds head height; palpus reddish-yellow, shorter than usual but well over one-half length of third antennal segment; eye bare, rather small; cheek one-third eye height; back of head moderately bulged on lower part, clothed with black hairs above and pale ones about the neck and below.

Thorax and scutellum black, gray pollinose, not distinctly vittate above. Chaetotaxy: acrostichal 1, 1; dorsocentral 3, 3; intraalar 2; supraalar 3; notopleural 2; presutural 1 (outer); humeral 2; postalar 2; intrapostalar differentiated; sternopleural 3; pteropleural hairlike; scutellum with 2 lateral and 1 smaller decussate apical pair; propleuron and postnotal slope bare. *Legs* rather long, wholly black; mid tibia with two anterodorsal bristles; claws and pulvilli distinctly elongated. *Wing* hyaline with yellow tinge at base and along costal margin; first vein bare, third with about three small hairs near base; cubitulus broadly rounded, without stump or fold; first posterior cell open well before wing tip; last section of fifth vein about one-fifth preceding section; epaulet black; calypter pale yellowish-white. *Abdomen* rather narrow and elongate, last three segments gray pollinose on basal three-fifths, remainder of each subshiny black; segments one and two each with one pair of median marginals and a complete marginal row on segments three and four, besides a discal row on last situated well behind the middle; hypopygium moderately large and prominent, shining black; sternites narrowly exposed at least apically.

Female—Front at vertex 0.43 of head width; parafrontal pale yellowish-

gray; ocellars and uppermost orbital divaricate, lower two orbitals proclinate; outer vertical differentiated; third antennal segment less than twice as long as second which is tinged with red on extreme apex; last three abdominal segments with heavier gray pollen extending to the apical third or fourth on each; genitalia black, retracted within tip of abdomen; claws and pulvilli shorter than last tarsal segment. Length, 7.5 mm.

Holotype male and *allotype* female, LIND, WASHINGTON, June 1 and 12, 1919 (R. W. Carlson).

The species is distinctly grayer and less shining in general aspect than the genotype, *M. latipennis* Aldrich. The latter differs further in having smaller, wholly black palpi, third antennal segment but little longer than second, back of head more distinctly bulged or swollen, wings broader apically and no differentiated preacrostichal bristles.

Erycia picata Reinhard, new species

Male—Front rather narrow, at vertex 0.20 of head width; parafrontal blackish above with tawny to subgolden pollen before middle, extending downward over parafacial; frontal vitta deep velvety red, narrower than parafrontal on upper half; outer verticals and orbitals absent; ocellars long, proclinate; frontal rows moderately divergent anteriorly, four or five bristles beneath antennal base, two stoutish reclinate preverticals; antenna about three-fourths length of face, basal segments more or less reddish, third black, twice as long as second; arista micro pubescent, moderately thickened on basal third, proximal segments small; parafacial narrow, bare on lower half; clypeus gray pollinose, moderately impressed, facial ridge bristled on lowest fourth; vibrissae stout, decussate, on oral margin; cheek gray pollinose, beset with black hairs, one-sixth eye height; eye bare, reaching about to vibrissal level; palpus reddish-yellow becoming darker basally; haustellum very short; labella large and fleshy; back of head gray pollinose, moderately clothed with pale or whitish hairs.

Thorax subshining black, lightly dusted with bluish white pollen, dorsal vittae scarcely visible; scutellum concolorous with thorax but with a reddish tinge in ground color near apex. Chaetotaxy: acrostichal 3, 3; dorsocentral 3, 4; intraalar 3; supraalar 3; presutural 2; notopleural 2; humeral 4; sternopleural 3; pteropleural 1 (smaller than sternopleural); postalar 3; intrapostalar well differentiated; scutellum with 3 lateral, 1 decussate apical and 1 discal pair; postnotal slope and propleuron bare. *Legs* black; claws and pulvilli strongly elongated, latter almost equal combined length of last two tarsal segments; mid tibia with two anterodorsal bristles. *Wing* subhyaline with a brownish tinge costobasally; first vein bare, third with two to four hairs near base; cubitulus broadly rounded, without stump or fold; first posterior cell narrowly open well before wing tip; last section of fifth vein slightly over one-fourth length of preceding; costal spine vestigial; calypter uniformly light brown; epaulet and subepaulet black. *Abdomen* black, moderately shining, entire surface above thinly dusted with bluish white pollen; hairs coarse and erect becoming bristly along median line of inter-

mediate segments, which bear usually two pairs of differentiated discals often irregularly spaced; basal segments each with one pair of median marginals and a marginal row on segments three and four besides numerous scattered discals on the latter above; hypopygium blackish, moderate prominent; forceps unusually broad in profile, rounded on apex; accessory process slightly exceeding length of forceps but much narrower and gently bowed from base to bluntly rounded tip; fifth sternite black, with a deep median excision, lobes beset with black hairs and bristles.

Female—Front at vertex 0.26 of head width; outer verticals differentiated; two pairs of proclinate orbitals present; tibiae more or less reddish; claws and pulvilli shorter than apical tarsal segment; calypter not so strongly infuscated; hairs on abdomen above subappressed; anal cerci reddish, short and bluntly rounded apically, beset with fine brown hairs. Length, 9-10 mm.

Holotype male and *allotype* female, on same pin (Calif. Acad. Sci., Ent.): BERKELEY, CALIFORNIA, April 23, 1949 (P. D. Hurd). *Paratypes:* 4 ♂ ♂, same locality as type, March 29 to June 15, 1948-49 (P. D. Hurd and U. N. Lanham); and 4 ♂ ♂, Monrovia Canyon, Calif., May 31, 1931 (Dorothy Martin).

The species is readily distinguished from allied forms by the narrower front, shorter antennae, infuscated calypters and the thinner patternless pollen on the abdomen.

Erycia sectilis Reinhard, new species

Differs from the preceding species chiefly as follows:

Male—Front wider, at vertex 0.32 of head width; parafrontal grayish pollinose to vertex, with a secondary row of frontals outside the main row before middle; outer verticals differentiated; antenna reaching nearly to oral margin, third segment three times longer than second; parafacial gray pollinose; cheek one-fifth eye height; thorax more densely pollinose above and marked with four distinct dark vittae; pulvilli hardly exceeding length of apical tarsal segment; wing gray hyaline, at most with a slight yellowish tinge near base and on costal margin; calypter opaque white; last three abdominal segments with rather dense gray pollen on basal edge which extends thinly to about the middle of each, the broad hind margins shiny black in direct view; forceps considerably narrower than in *E. picata* n. sp. *(vide supra)*; accessory process nearly as wide as forceps in profile. Length, 8–9 mm.

Female unknown.

Holotype male, TETON PASS, WYOMING, August 2, 1947 (F. A. Cowan and M. R. Wheeler). *Paratype:* 1 ♂, same data as type.

The Publications Committee regrets having to postpone the E. C. Van Dyke Memorial number until the April issue of the Pan-Pacific Entomologist. It proved impossible to have Dr. Van Dyke's posthumous papers and an adequate obituary and bibliography ready in time for the present issue.

DIPTERA REARED FROM BARN OWL NESTS

RAYMOND E. RYCKMAN

Two nests of the barn owl *(Tyto alba pratincola* (Bonaparte), located seven miles west of Riverside, California, were examined and debris from the nests taken to the laboratory on April 18, 1952. Nine young owls were capable of limited flight at this time. Parasites and those forms breeding in organic material of the nests were most prevalent. The owls nested in abandoned rodent burrows approximately seven feet from the top of a 35-foot precipitous clay cliff.

The following Diptera were reared from nest material which was placed in gallon jars and covered with bleached muslin to exclude other flies or their larvae.

MUSCIDAE: *Muscina stabulans* (Fallen), 3 adults; MILICHIIDAE: *Leptometopa latipes* (Meigen), 10 adults; HELEOMYZIDAE: *Neossos marylandica* (Malloch), 32 adults.

The author is indebted to Curtis W. Sabrosky for identification of the above Diptera. Concerning *N. marylandica*, he states the following, "So far as I know, it has not been recorded since it was described from Maryland." Specimens of each species has been retained by the U. S. National Museum.

ADOXOMYIA CLARIPENNIS COLLECTED FROM WOOD RAT NESTS IN ARIZONA

(Diptera: Stratiomyidae)

RAYMOND E. RYCKMAN[1] and CHARLES T. AMES[1]

On December 27, 1952, wood rat nests were examined near Mission Tucson, west of Tucson, Arizona. Two typical Stratiomyidae larvae were collected from one rat nest which was built under overhanging ledges of an embankment. The larvae were reared to adults and pinned with the pupal cases: they were a male and female of *Adoxomyia claripennis* James. This material was identified by W. W. Wirth and retained by the U. S. National Museum. The female of this species has not previously been collected.

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Proceedings

Two Hundred and Twenty-second Meeting

The two hundred and twenty-second meeting of the Pacific Coast Entomological Society was held at 7:30 p. m. on Friday, January 25, 1952, in the Morrison Auditorium of the California Academy of Sciences, San Francisco. President Essig conducted the meeting. The following members were present: D. D. Jensen, W. W. Middlekauff, A. E. Michelbacher, E. G. Linsley, K. F. Innes, C. W. Hildebrand, H. H. Meyer, E. L. Kessel, Richard M. Bohart, George E. Bohart, J. W. MacSwain, E. C. Van Dyke, G. F. Ferris, E. S. Ross, J. W. Green, C. Don MacNeill, W. C. Bentinck, W. C. Day, R. F. Smith, Benjamin Keh, F. E. Skinner, P. H. Arnaud, D. G. Denning, A. E. Pritchard, Laura M. Henry, Walter Thomsen, Lee A. Wood, Jr., W. D. Murray, J. G. Rozen, Jr., R. L. Doutt, H. B. Leech, P. D. Hurd, Jr., and E. O. Essig. The following visitors attended: Margaret Bohart, Helen L. Day, Ruth Ogren, Frances Murray, Madeline Jacobi, and Barbara L. Rozen.

The minutes of the meeting held December 7, 1951, were read and approved.

Professor Essig called for notes, remarks and exhibits and circulated the Bulletin of the Oregon Entomological Society and a new book by Dr. Curran entitled "Insects in Your Life."

Dr. Michelbacher called attention to the publication of the latest issue of Entoma.

Dr. Doutt displayed what he considered to be the best photographic illustrations of the aeroscopic plate of parasitic hymenoptera. This plate, which is peculiar to certain genera in the Encyrtidae, is an unusual section of sculptoring on the chorion of the egg. After the larva hatches from the egg it continues to utilize the aeroscopic plate as an air passage to the outside of the host. The photographs were made by Maurio Martignoni, a visiting student at the University of California, from Switzerland.

Mr. Leech displayed a British book by G. J. Arrow entitled, "Horned Beetles, A Study of the Fantastic in Nature."

The President then introduced Dr. Paul D. Hurd, of the University of California, who spoke on "Species formation in the spider-wasp genus *Pepsis*."

The genus *Pepsis* is an exclusively New World group of spider-wasps. At present, the genus contains some 428 recognized species; however, the actual number in nature probably approximates 150 since many of the described species are represented by the unassociated sexes and a high per-

centage of the names are applied to non-population phenomena. Additional reduction of names is anticipated following the further application of the principles of polytypy.

Species formation in the genus appears to be the result of geographic segregation occasioned largely through isolating mechanisms developed and accentuated in areas of ecological distinctiveness. Examples to substantiate this view were given and may be found in "Revision of the Nearctic species of the Pompilid genus Pepsis," Amer. Mus. Nat. Hist., 98: 257–334.

After a discussion of Dr. Hurd's well-illustrated talk, the meeting was adjourned.—D. D. Jensen, *Secretary*.

Two Hundred and Twenty-third Meeting

The two hundred and twenty-third meeting of the Pacific Coast Entomological Society was held at 2:00 p. m. on Saturday, February 23, 1952, in the Morrison Auditorium of the California Academy of Sciences, San Francisco. President Essig conducted the meeting. The following members were present: E. O. Essig, P. H. Arnaud, J. P. Harville, W. L. Hoyt, V. Stombler, E. C. Van Dyke, F. X. Williams, J. W. MacSwain, A. E. Michelbacher, E. G. Linsley, R. L. Usinger, A. E. Pritchard, W. D. Murray, W. C. Day, P. D. Ashlock, W. C. Bentinck, J. G. Rozen, R. F. Smith, R. L. Doutt, L. M. Henry, J. W. Tilden, C. W. Hildebrand, R. Morgan, D. D. Linsdale, C. Downing, K. S. Hagen, M. Marquis, F. E. Skinner, J. I. Stage, R. R. Snelling, Wm. Hazeltine, J. Balch, J. R. Walker, G. A. Marsh, D. P. Furman, H. B. Leech, J. W. Green, H. H. Blakemore, B. Keh, J. F. Gustafson, K. F. Innes, Jr., J. D. Lattin, D. D. Jensen, G. F. Ferris, E. S. Ross, J. A. Wood, and C. P. Hoyt. Visitors were present as follows: C. E. Kaufeldt, J. J. Marquis, Mr. and Mrs. Ned O. Thompson, Iola W. Barber, C. D. Gray, S. M. Gon, Bert E. Traud, Jr., B. E. Traud, Barbara Prendergast, Helen Faulkner, E. E. Gilbert, W. R. Kellen, and Ruth Ogren.

The minutes of the meeting held January 25, 1952 were read and approved.

Peter Ashlock and Joseph Schuh were elected to membership in the Society.

In response to a request for notes and exhibits, Dr. MacSwain reported that during the 1951 University of California summer course in entomology, held in the vicinity of Sonora Pass, he had caught several male and female grylloblattids of a new species. Most of the specimens were sent to Dr. Gurney but three were kept alive in a refrigerator at Berkeley for several months. The single survivor was exhibited at the meeting. According to Dr. Gurney, the life cycle of this insect extends over six or seven years.

Dr. Doutt displayed a recently-introduced coccinellid beetle which was imported into California from Israel for olive scale control. The species, *Chilocorus bipustulatus* (Linn.), was collected and shipped by Dr. Boyce during his recent visit to that country.

Dr. Jensen suggested that each year a list could be published in the

Pan-Pacific Entomologist of insect species which had been recorded in California for the first time during the previous year. This would include species introduced for biological control as well as those which are not purposely brought into the state.

Mr. Leech called attention to a carefully mounted and labeled collection of Mexican insects taken by Manuel and Joseph Marquis during 1951.

Professor Essig displayed the recently published book, "An Introduction to Acarology" by Baker and Wharton and called on Dr. Pritchard who stated that it was the only comprehensive work done on the group in our generation.

Dr. Don Murray displayed color maps he prepares to record the abundance of mosquitoes and made the following comments regarding their problem:

"In mosquito control work there have been several cases in the world where complete eradication of a species was obtained, but our mosquito districts in the San Joaquin Valley do not dare talk in such terms because of public misunderstanding. However, we have sometimes obtained reductions in numbers to the extent that the pest problem has been reduced to a minimum.

"*Aedes nigromaculis*, the field mosquito, is potentially the worst pest mosquito in the San Joaquin Valley. Eggs are laid in moist soil, with permanent pastures as the preferred egg-laying fields. The eggs hatch on flooding. However, only a certain percentage hatches at one time, the remainder lying dormant until one or more successive floodings provide the hatching stimulus. The larvae are readily visible in the water and can be recorded as a given number per dip. Untreated, suitable areas usually have from 50 to several hundred larvae per dip.

"With repeated treatment of insecticide on each flooding, thus preventing any emergence of adults over a sufficient area, and with no significant number of adults migrating in to reinfest the area, larval counts have been gradually reduced to a very low point. We have adapted a method for presenting our data which was developed by Robert Shotwell in grasshopper control work. Using colors, specifically red, purple, yellow and green, to show different levels of population, we can picture the infestation at any given time, we can interpret increases and decreases, and we can better plan our control program."

Mr. E. E. Gilbert reported that during a recent collecting trip to Imperial County, California, a female tiphiid, *Brachycistis* sp. near *furtivus* (Mickel and Krombein), was dug from below a small shrub and represents the twenty-sixth known female specimen of its subfamily. Adults of *Ligyrus gibbosus* (De Geer) taken in the same ecological niche might suggest a possible host relationship. In addition, two species of mutillids were collected: *Dasymutilla phoenix* (Fox), a new record for California, and *Dasymutilla paranocturna* Barr and Hurd, the sixth known specimen of this species. The Hymenoptera were identified by Dr. P. D. Hurd.

Professor Essig introduced Professor G. F. Ferris and Mr. Charles Hoyt of Stanford University for their discussion of "The Evolution of the Diptera."

Introductory remarks on the principles of comparative morphology of arthropods were given by Professor G. F. Ferris. Professor Ferris emphasized the necessity for the development of a set of definite principles as a foundation for comparative morphological studies. These principles should be congruent with the results and doctrines of modern biological investigations and thoughts.

Also included in these introductory remarks was the fact that suitably preserved material of the less well-known groups of insects was extremely difficult to obtain. This lack is keenly felt by students of comparative morphology of insects.

Dr. Charles P. Hoyt followed Professor Ferris with an illustrated talk on the evolution of the Diptera from the viewpoint of comparative morphology. The following is an abstract of his presentation:

Preparatory to an understanding of the changes which resulted in the development of the structures of the Diptera, it is necessary to understand the components of the generalized insect which presumably preceded these changes. An example of such a generalized arrangement is found in the mouthparts of the cockroach, *Blatella germanica* (Linnaeus). By comparing the morphological features of the cockroach with those of certain of the Neuroptera such as *Chrysopa californica* Coquillett and *Stenorrhachus walkeri* MacLachlan as well as the Mecopteran, *Nannochorista dipteroides* Tillyard, the structural components of the Nematocerous mouthparts may be understood and an idea of the extent and pathway of their evolution can be gained.

In addition to a comparative morphological consideration of the mouthpart structures, a study of the morphology of the thorax lends support to the conclusions reached from mouthpart studies. It is not necessary, however, to return to the cockroach for an example of a generalized thorax, as the Mecopteran *Nannochorista dipteroides* has retained fairly well the generalized thoracic pattern. By comparing this arrangement with that of the Nemopterid and the latter in turn with the generalized Dipterous thorax, such as that of a Tipulid, the stages of evolutionary modification can be clearly demonstrated.

It is concluded from these considerations that the Nemopterid *Stenorrhachus walkeri* is, morphologically, the best living example of what the ancestral stock of the Diptera must have resembled.

Following a discussion of the paper, the meeting was adjourned.—D. D. Jensen, *Secretary.*

Two Hundred and Twenty-fourth Meeting

The two hundred and twenty-fourth meeting of the Pacific Coast Entomological Society was held at 2:00 p. m. on Saturday, March 22, 1952, in the Morrison Auditorium of the California Academy of Sciences, San Francisco. President E. O. Essig conducted the meeting. The following members were present: J. W. MacSwain, C. D. Grant, Thomas Lauret, E. C. Van

Dyke, A. E. Michelbacher, J. W. Green, H. B. Leech, E. G. Linsley, W. C. Day, E. S. Ross, J. L. Gressitt, R. M. Bohart, K. F. Innes, Jr., E. E. Gilbert, W. C. Bentinck, W. V. Garner, G. A. Marsh, C. A. Downing, P. D. Ashlock, W. W. Middlekauff, T. Aarons, D. P. Furman, W. H. Lange, L. R. Gillogly, P. H. Arnaud, J. R. Walker, E. O. Essig, and D. D. Jensen. The following visitors were also present: E. I. Schlinger, G. Pronin, R. C. Bechtel, A. D. Telford, Mary Telford, Margaret Bohart, Grace Bechtel, Mrs. L. R. Gillogly, Alan Gillogly, James Gillogly, and Mr. and Mrs. S. Winnan.

The minutes of the meeting held February 23, 1952, were read and approved.

Raymond E. Ryckman, Mrs. Velma Knox Mayo, R. C. Bechtel, and Dr. Edwin P. Meiners were elected to membership in the Society.

President Essig appointed the following members to serve as a committee to make arrangements for the field meeting to be held May 25; Dr. Jensen, Dr. Ross and Mr. Leech.

Dr. Gressitt reported briefly on the project with which he is associated and which is sponsored by the National Research Council and the Pacific Science Board. It involves a study of the insects of Micronesia and is financed at present by the Office of Naval Research. Dr. Gressitt is arranging for identification of the various insect groups by specialists.

President Essig introduced Dr. Richard M. Bohart, of the University of California at Davis, who spoke on "Problems of Mosquito Speciation in the Pacific Area." A summary of Dr. Bohart's address follows:

The Pacific mosquito fauna was very imperfectly known prior to World War II, but the state of knowledge was greatly improved by the many fine collectors who went out as entomologists for the Army and Navy. In 1944 the U. S. National Museum, which boasts the finest collection in the world of Philippine mosquitoes, had representatives of 128 of the 150 known species. Today we know of at least 300 species from that area. This compares with 41 species in California which covers an area of similar size. The production of species through island isolation is found throughout the Pacific area. Many endemic species occur on the larger island groups such as New Guinea, the Dutch East Indies, and the Philippines, but only a few such species occur in the more isolated mid-Pacific islands of Polynesia and Micronesia. On the other hand, the *percentage* of endemic species is much higher in the more remote areas.

The Ryukyus represent an intermediate "semi-remote" situation. On this island chain 49 species are at present known, of which 16 appear to be endemic. The non-endemic forms are mostly found also in China, some 400 miles to the west. This can be compared with the many mid-Pacific islands of the Marianas, Carolines, and Marshalls, collectively known as Micronesia, where out of 28 subspecies and species 20 are endemic. Another comparison can be made with the land area of China with 118 species and only 7 apparently endemic. Two groups of mosquitoes which are found only on Pacific islands and which illustrate the extent of island speciation

are the *Aedes pandani* group and the *Aedes scutellaris* group. The five species of the former stretch over the Marianas and the 11 species of the latter are scattered from Guam and Tahiti to New Guinea and Okinawa. Although the differences between species from adjacent islands often appear to be slight, there is no evidence of inter-breeding in nature when they are brought together through the agency of man.

Colored slides were shown illustrating the types of habitats found in the Marianas and the Ryukyus.

Dr. Bohart's paper was followed by a discussion before the meeting was adjourned.—D. D. Jensen, *Secretary*.

Two Hundred and Twenty-fifth Meeting

The annual field meeting of the Pacific Coast Entomological Society was held at Mt. Tamalpais, Marin County, California, May 25, 1952. Although the weather was very pleasant, the attendance was smaller than at other recent field meetings. Eight members and 19 friends attended. Some collecting was done, but most of the time was spent in visiting.

—D. D. Jensen, *Secretary*.

Two Hundred and Twenty-sixth Meeting

The two hundred and twenty-sixth meeting of the Pacific Coast Entomological Society was held at 2:00 p. m. on November 8, 1952, in the Morrison Auditorium of the California Academy of Sciences, San Francisco. President Essig conducted the meeting. The following members were present: J. W. MacSwain, D. D. Jensen, E. G. Linsley, E. O. Essig, R. F. Smith, R. L. Usinger, E. E. Gilbert, C. D. MacNeil, J. R. Helfer, L. R. Gillogly, W. C. Day, J. G. Edwards, P. H. Arnaud, J. P. Harville, Laura Henry, G. F. Ferris, K. S. Hagen, T. F. Leigh, A. E. Michelbacher, R. L. Doutt, E. S. Ross, E. L. Kessel, J. W. Green, Paul Cook, H. B. Leech, Clarence Downing, G. A. Marsh, John J. Drea, Robert Morgan, and Donald Linsdale. The following visitors attended: John Smart, Alice Gray, James W. Chapman, Mrs. Lorin Gillogly, Alan Gillogly, Jim Gillogly, S. E. Abul Nasr, Helen L. Day, C. E. Kaufeldt, Herbert A. Dean, William Hovanitz, Robert Langston, Robert Schuster, Dewey L. Shepherd, and Neil A. Walker.

The minutes of the field meeting held May 25, 1952, were read and approved.

The following were elected to membership in the Society: Alice E. Gray, John J. Drea, Paul P. Cook, and Carlos E. Kaufeldt.

President Essig appointed the following two committees to prepare reports for presentation at the annual meeting in December. Nominating committee: A. E. Michelbacher, H. B. Leech, and J. G. Edwards. Auditing committee: E. L. Kessel, D. D. Jensen, and E. S. Ross.

President Essig called attention to the recent death of Dr. Edwin C. Van Dyke, charter member of the Society. He indicated that at a later date

Dr. Van Dyke's life and the many valuable contributions he made to the Society and its publications would be discussed more fully. Dr. Ross stated that a full issue of the Pan-Pacific Entomologist would be devoted to Dr. Van Dyke and his work. He mentioned also that within the past year a sound tape recording had been made of a two-hour conversation with Dr. Van Dyke regarding his entomological career.

In response to President Essig's call for notes and exhibits, Mr. MacNeill displayed pieces of amber from Simojovel (Chiapas), Mexico. The amber is found most commonly along streams in the vicinity of the town and appears to be of Oligocene origin. In two instances insects have been found in amber from this area.

Mr. Gillogly exhibited specimens of Nitidulidae which strongly resembled the Lucanidae. They were collected on Guam and the Palau Islands and appear to represent a new genus.

Dr. Usinger circulated a vial containing specimens of the family Cryptostomatidae (Hemiptera:Heteroptera) which Dr. MacSwain had collected in Woolsey Canyon, Berkeley, California. The nearest known relative of this species occurs in Guatemala.

Dr. MacSwain exhibited a drawer of cercerid wasps and their prey which he and Dr. Linsley had collected this past summer in Southern California. From the burrows of twenty-eight wasps, over 1500 specimens representing twenty-one species of buprestids of four genera were taken. It was pointed out that the provisions of each wasp were not a random sample of buprestids but appeared to be correlated, at least in part, with the size of the individual wasps. However, other explanations will be necessary to explain why certain wasps had provisioned with only one or two species of buprestids to the exclusion of other species of comparable size.

Professor Essig commented that in England entomologists have found that aphids were stored in straws by wasps, and always only a single species of aphid was stored in a given straw. In California aphids have been found stored in hardwood trees where the pith had been hollowed out. All of them were apterae of an undescribed species.

Dr. Edwards reported that a student, collecting at Tucson, Arizona, had found mosquitoes of the genus *Megahrinus* which was previously not known west of Texas. The larvae are predaceous on larvae of other mosquitoes.

President Essig introduced Professor William Hovanitz, of the University of San Francisco, who presented an illustrated discussion on the subject "Hybridization between different *Colias* species." A summary of his remarks follows:

Hybridization between species and subspecies of *Colias* has been found to be very common, not only in North America but in Eurasia as well. Work on natural hybridization between *Colias eurytheme* and *Colias philodice* in North America has been followed by work on various species of the arctic, especially *Colias nastes* and *Colias hecla*. Evidence of hybridization has come from various sources: intermediates in wild populations, breeding from wild intermediates, crossing of two species in the laboratory, analysis of

mating pairs in the wild. Hybridization has been shown to occur between forms geographically separated but contiguously located as well as those which overlap widely. In some cases, hybridization of the subspecies sort has been shown to be accompanied by a change in dominance of a "dominant" gene in populations. Natural "hybrids" are probably very rare but the products of such intercrossing are not. These latter are called "intermediates."

Eurasiatic species of *Colias* have also been shown to hybridize. For example, *Colias hyale* and *Colias croceus* of western Europe blend in central and southern Russia but re-emerge eastward as quite different appearing species—*Colias erate* and *Colias fieldi.*

Colias hecla and *Colias nastes*, which hybridize in North America, also do so in Scandinavia. Here, however, the habits of the two have become different. In consequence of this fact the introgression in America is from *C. nastes* into *C. hecla* but in Europe is from *C. hecla* into *C. nastes.*

For a thorough understanding of the interrelationships of insects and for a more certain taxonomic system, work on the physiological, ecological, and genetical traits must be blended into the differences detected by morphology alone.

After some discussion of the paper, the meeting was adjourned.—D. D. Jensen, *Secretary.*

Two Hundred and Twenty-seventh Meeting

The two hundred and twenty-seventh meeting of the Pacific Coast Entomological Society was held at 2:00 p. m. on Saturday, December 6, 1952, in the Morrison Auditorium of the California Academy of Sciences, San Francisco. President Essig conducted the meeting. The following members were present: Alice Gray, W. W. Middlekauff, E. G. Linsley, E. S. Ross, P. D. Hurd, J. W. MacSwain, E. L. Kessel, A. E. Michelbacher, John Drea, W. C. Bentinck, W. C. Day, J. D. Lattin, Wm. Hazeltine, H. B. Leech, G. F. Ferris, C. D. MacNeill, W. V. Garner, R. C. Miller, F. L. Blanc, G. A. Marsh, P. H. Arnaud, J. W. Tilden, J. G. Edwards, Victor Stombler, Ryuichi Matsuda, Lee A. Wood, A. E. Pritchard, Laura M. Henry, L. R. Gillogly, Benjamin Keh, C. E. Kaufeldt, J. W. Green, K. F. Innes, E. O. Essig, D. D. Jensen, Paul Bartholomew, and Lawrence Swan. Visitors attended as follows: J. Bergamin, N. A. Walker, S. E. Abul Nasr, Mostafa Hafez, Mrs. W. C. Day, H. R. MacCarthy, E. S. Sylvester, John Smart, R. Duncan Carter, W. Anthony Doalin, A. R. Gillogly, James Gillogly, Mrs. L. R. Gillogly, Glen M. Cagley, John C. Downey, and John O. Stivers.

The minutes of the meeting held November 8, 1952, were read and approved.

The following were elected to membership in the Society: Paul S. Bartholomew, Avelino Bigornia, F. Louis Blanc, Dewey L. Shepherd, Ian Moore, Ryuichi Matsuda, and Lawrence W. Swan.

Dr. Miller reported to the Society on the financial status of the organization.

Dr. Ross, representing the auditing committee, reported that the financial books of the Society had been audited and were found in good condition.

President Essig then called for notes and exhibits of entomological interest.

The secretary requested that members presenting notes and exhibits write out the information given and transmit the accounts to the secretary so that the reports may be as accurate as possible when they are published.

Mr. Arnaud displayed two specimens of a colorful fly, *Tachinisca cyaneiventris* Kertesa, of the family Tachiniscidae, which were collected at Chanchamayo, Dp. Junin, Peru. He pointed out that this small and rare family has been reported only from South America and Africa.

Dr. Pritchard reported that although the Odonata have been popular with collectors for many years and a large number of scientists have been devoted to their taxonomic study, occasionally a new species is found in the United States. Recently while working over the California Academy collection, Dr. Pritchard found three new species: a new *Tanypteryx*, a genus of primitive and rare dragonflies, a new *Ophiogomphus* and a new *Ischnura*.

Dr. Tilden reported that *Philotes rita* B. & McD., a butterfly whose type locality is listed as "Mts. of southern Arizona" was collected August 31 and September 2, 1952, in Ramsey Canyon, Arizona, by J. W. Tilden, Lloyd M. Martin and Mr. Ford. This species is one of the rarest of the genus.

Mr. Leech displayed Dr. Van Dyke's field note books starting in 1892. He pointed out that reference to these records had been of value in checking the accuracy of data not completely given on some of the specimens collected.

President Essig called on Dr. Michelbacher, chairman of the nominating committee, who proposed the following as officers of the Society for 1953: J. W. MacSwain, President; J. Gordon Edwards, Vice-president; D. D. Jensen, Secretary; R. C. Miller, Treasurer; E. L. Kessel and G. F. Ferris, Members at Large. They were unanimously elected.

The chairmanship of the meeting was then turned over to President-elect MacSwain who called on Professor Essig to give his retiring presidential address entitled "Aphid Miscellany." Professor Essig's interesting paper is published in full in this issue of the Pan-Pacific Entomologist.

Following a discussion of Professor Essig's paper the meeting was adjourned.—D. D. Jensen, *Secretary*.